TABLE OF CONTENTS

Vol. 10, No. 5, March 15, 1956

NUCLEAR SCIENCE ABSTRACTS

Volume 10 March 15, 1956 No. 5

GENERAL

ATOMIC POWER

1977 DL-21
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
ATOMIC ENERGY 1955. Public Lecture at the Royal Military College of Canada, Kingston, Ontario, on November 10, 1955. W. B. Lewis. 14p. (AECL-263).

The physics, engineering, and economics of nuclear power reactors are briefly discussed for the layman. (M.P.G.)

BIOLOGY AND MEDICINE

1978 AERE-Lib/Trans.-559
DISPLACEMENT OF THE OESOPHAGUS BY AN ABNORMAL COURSE OF THE ARTERIA SUBCLAVIA DEXTRA (ARTERIA LUSCRIA). B. Kommerell. 1955. 7p. Translated by J. B. Sykes from Gebiete der Rontgenstrahlen, 54, 590-5(1936).

1979
DIFFERENTIAL OPTICAL STAINING OF COLORLESS LIVING ORGANISMS IN MACRO-PHOTOGRAPHY. Robert F. Smith (Brookhaven National Lab., Upton, N. Y.). J. Biol. Phot. Assoc. 23, Nos. 2 & 3, 74-7(1955) May-Aug.

1980
EFFECTS OF BLOOD FLOW ON DIFFUSION KINETICS IN ISOLATED, PERFUSED HINDLEGS OF CATS. A DOUBLE CIRCULATION HYPOTHESIS. Eugene M. Renkin (Brookhaven National Lab., Upton, N. Y.). Am. J. Physiol. 183, 125-36(1955) Oct.

1981
STUDIES ON TRICHINELLA SPIRALIS. I. CONCERNING THE TIME AND SITE OF INSEMINATION OF FEMALES OF TRICHINELLA SPIRALIS. II. TIME OF INITIAL RECOVERY OF LARVAE OF TRICHINELLA SPIRALIS FROM BLOOD OF EXPERIMENTAL ANIMALS. III. EFFECT ON THE INTESTINAL PHASE OF TRICHINOSIS OF FEEDING MASSIVE NUMBERS OF IRRADIATED TRICHINA LARVAE. IV. EFFECT OF FEEDING IRRADIATED TRICHINELLA LARVAE ON PRODUCTION OF IMMUNITY TO RE-INFECTION. V. TESTS FOR STRAIN OF TRICHINA LARVAE RESISTANT TO RADIATION. S. E. Gould, H. J. Gomberg, F. H. Bethell, J. B. Villella, and C. S. Hertz (Univ. of Michigan, Ann Arbor; Wayne County General Hospital, Eloise, Mich.; and Wayne Univ. Coll. of Medicine, Detroit). Am. J. Pathol. 31, 933-63 (1955).

AEROSOLS

1982 UR-415
Rochester, N. Y. Univ. Atomic Energy Project.
THE CONTROL AND MEASURING SYSTEMS OF AN APPARATUS FOR THE STUDY OF RESPIRATORY TRACT RETENTION. Donald A. Morken and Paul E. Morrow. Nov. 22, 1955. 40p. Contract W-7401-eng-49.

A technical description of the various electronic components of a new apparatus for the study of respiratory deposition and retention is given with appropriate wiring diagrams. The performance characteristics of the apparatus are reported in the form of various tests and calibration procedures which have been applied. The equipment has been employed in aerosol studies in man to a limited extent. The operation of the apparatus indicates that it will permit the study of pulmonary deposition in relation to both the characteristics of the aerosol and the physiology of respiration. (auth)

RADIATION EFFECTS

1983 UR-295
Rochester, N. Y. Univ. Atomic Energy Project.
THE EFFECT OF POLONIUM ALPHA PARTICLE IRRADIATION UPON RETICULOENDOTHELIAL FUNCTION AS MEASURED WITH P^{32} LABELED PARTICULATE CHROMIC PHOSPHATE. L. W. Tuttle and R. C. Baxter. Oct. 10, 1955. 34p. Contract W-7401-eng-49.

Internally deposited Po^{210} (37 uc/kg) was used to administer α particle irradiation continuously to rats over periods up to 23 days. The spleens of Po treated animals received as much as 6200 rep and livers received up to 580 rep of α particle irradiation. At time intervals of 2, 4, 6, 10, 14, and 23 days after Po administration, studies of reticuloendothelial function of the rats were made with the use of P^{32} labeled particulate chromic phosphate. The half time for removal of injected chromic phosphate from the circulation was slightly increased in Po treated animals by 14 days at which time spleens had received 3700 rep and livers 400 rep of α particle irradiation. The total amount of particulate material removed from the circulation by entire spleens and livers was not significantly altered despite intensive irradiation of the reticuloendothelial cells. The amount of injected particulate material removed per unit weight by spleens and livers of treated animals was significantly increased over control values. It is concluded that the reticuloendothelial cells of the liver and spleen are highly resistant to the effects of localized irradiation insofar as ability to remove circulating inorganic particulate material is concerned. The implications of these findings to the problem of post irradiation bacteremia are discussed. (auth)

1984 UR-418
Rochester, N. Y. Univ. Atomic Energy Project.
A COMPARISON OF THE EFFECTS ON BARE PORCINE

SKIN OF RADIANT ENERGY DELIVERED IN THE FORMS OF SQUARE AND SIMULATED FIELD PULSES. T. P. Davis, J. R. Hinshaw, and H. E. Pearse. Nov. 29, 1955. 14p. Contract W-7401-eng-49.

The critical energy required to produce a 2+ burn in the Chester White pig has been used as a method of comparing the effectiveness of radiant energy delivered in the forms of square pulses and simulated field pulses. With both types of pulse, increasing the time of exposure necessitates an increase in the total energy delivered in order to produce a 2+ burn. There is no significant difference between the scaling factors for the two types of pulse. (auth)

1985

COMPARISON OF BIOLOGICAL EFFECTS OF WHOLE-BODY IRRADIATION WITH 22.5-MEV X-RAYS, 18-MEV ELECTRONS, AND 400-KEV X-RAYS IN THE RAT. John B. Fuller, Irene Chen, John S. Laughlin, and Roger A. Harvey (Univ. of Illinois Coll. of Medicine, Chicago). Radiation Research 3, 423-34(1955) Dec.

1986

TESTS FOR A ROLE OF H_2O_2 IN X-RAY MUTAGENESIS. II. ATTEMPTS TO INDUCE MUTATIONS BY PEROXIDE. R. F. Kimball, J. Z. Hearon, and N. Gaither (Oak Ridge National Lab., Tenn.). Radiation Research 3, 435-43(1955) Dec.

1987

THE SPLEEN-THYMUS WEIGHT RESPONSE TO TOTAL-BODY X-IRRADIATION IN THE ADRENALECTOMIZED RAT AND MOUSE. Mortimer L. Mendelsohn ((Walter Reed Army Medical Center, Washington, D. C.). Radiation Research 3, 444-51(1955) Dec.

1988

INFLUENCE OF YOLK ON MITOTIC RATE IN UNTREATED AND X-RAYED GRASSHOPPER NEUROBLASTS IN VITRO. Mary Esther Gaulden and Katherine L. Kokomoor (Oak Ridge National Lab., Tenn.). Proc. Soc. Exptl. Biol. Med. 90, 309-14(1955) Nov.

1989

METHEMOGLOBINEMIA INDUCED BY X-IRRADIATION. Robert M. Dowben and Jack K. Walker (U. S. Air Force School of Aviation Medicine, Randolph Field, Tex.). Proc. Soc. Exptl. Biol. Med. 90. 398-400(1955) Nov.

1990

MORPHOLOGICAL CHANGES IN THYMUS OF RATS FOLLOWING WHOLE-BODY EXPOSURE TO MASSIVE DOSES OF RADIATION. F. Stephen Vogel and John C. Ballin (U. S. Air Force School of Aviation Medicine, Randolph Field, Tex. and U. S. Air Force Radiation Lab., Chicago). Proc. Soc. Exptl. Biol. Med. 90, 419-23(1955) Nov.

1991

THE OXYGEN CONSUMPTION FOLLOWING X IRRADIATION OF ALLESCHERIA BOYDII 1699 IN A BIOTIN-RICH MEDIUM. A. Morczek and D. Mucke. Strahlentherapie 98, 277-83(1955) Oct. (In German)

The authors investigated the O_2 consumption after roentgen irradiations of Allescheria boydii 1699, an ascomycete requiring biotin. The experiments were made by means of Warburg's apparatus in a suspension medium with and without biotin. In both series, a decrease of the O_2 quotient was observed at doses from 100 to 500 kr. A residual respiration of approximately 45% of the control value remained unchanged after increasing the dose beyond 400 kr. Upon denaturation with heavy metallic salts (Ag_2SO_4 and $HgCl_2$) in concentrations of 10^{-3} m and heat (100°C), the residual respiration of the mycelium disappeared completely. The residual respiration observed after the irradiation, is attributed to the redox potentials of the reaction groups formed during the irradiation of the protein of the fungus. (auth)

RADIATION HAZARDS AND PROTECTION

1992 ANL-5446

Argonne National Lab., Lemont, Ill.

ENVIRONMENTAL RADIOACTIVITY AT ARGONNE NATIONAL LABORATORY. Report for the Year 1954. J. Sedlet. Dec. 1955. 40p. Contract W-31-109-eng-38.

Concentrations of radioactivity in rain, surface water, soil, plants, animals, and material from the beds of surface waters (bottom silt) which were collected and analyzed in 1954 are given in this report. These samples were collected from the ANL site and from zones 10, 25, and 100 miles from the Laboratory. The sampling locations 100 miles from the Laboratory are referred to as reference sites. Since Laboratory waste water is discharged into Sawmill Creek, which in turn empties into the Des Plaines River, special emphasis was placed on sampling these streams. Most of the results were obtained by counting the total alpha and beta activities. Some of the water samples were also analyzed for specific nuclides and elements. The total activity measurements provided a rapid means of obtaining values for a large number of samples. These values may be used for comparative purposes and also indicate which samples should be analyzed in more detail. Data are tabulated. (auth)

1993 APEX-218

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

RADIOLOGICAL EDUCATION AND TRAINING PROGRAM — INDUSTRIAL HYGIENE. 1955. 28p.

Methods and materials employed in the radiological education and training program of the General Electric Company are described. (C.H.)

1994 K-1088

Carbide and Carbon Chemicals Co. K-25 Plant, Oak Ridge, Tenn.

AIR-BORNE CONTAMINATION RESULTING FROM TRANSFERABLE CONTAMINATION ON SURFACES. J. C. Bailey and R. C. Rohr. Nov. 24, 1953. Changed from OFFICIAL USE ONLY Sept. 6, 1955. 12p. Contract W-7405-eng-26.

A comparison of air-borne activity with transferable surface activity in two contaminated plant locations during normal operation indicates that the ratio of air activity to surface activity is in the range of about 0.25 to 1.9 (dis/min/m^3 air)/(dis/min/cm^2 surface). This latter figure is considered to be the maximum value of this ratio which might exist for long continued operations at K-25. However, a test designed to indicate the maximum activity which might result from plant operations included the combined action of air circulating fans and equipment vibrations and gave a corresponding ratio of about 20 (dis/min/m^3 air)/(dis/min/cm^2 surface) for short periods. (auth)

1995
INVESTIGATION OF A BIOLOGICAL PROTECTIVE SCREEN. PART XI. PROTECTIVE EFFECTS OF VARIOUS AMINES. H. Langendorff and R. Koch. Strahlentherapie 98, 245-54(1955) Oct. (In German)

The authors report their experiments regarding the protective action of different amines against the damaging influence of radiations. With the exclusion of tryptamine, all of the tested substances proved to be ineffective. The authors further discuss certain methodical questions in connection with the performance of such experiments. (auth)

1996
HAS PERISTON N A PROTECTIVE EFFECT AGAINST RADIATION? J. Becker and H. Kirchberg. Strahlentherapie 98, 343-7(1955) Oct. (In German)

1997
IMPLANTATION OF FUNCTIONAL ERYTHROPOIETIC ELEMENTS FOLLOWING TOTAL-BODY IRRADIATION. D. L. Lindsley, T. T. Odell, Jr. and F. G. Tausche (Oak Ridge National Lab., Tenn.). Proc. Soc. Exptl. Biol. Med. 90, 512-15(1955) Nov.

1998
PROTECTION OF MOUSE FETUS AGAINST X-IRRADIATION DEATH. Roberts Rugh and Helen Clugston (Columbia Univ., New York). Science 123, 28-9(1956) Jan. 6.

Cysteinamine administered to pregnant mice 20 min before exposure provided some protection against x irradiation not only for the adult mouse, but also for the fetal mouse. (C.H.)

1999
FAILURE OF MERCAPTOETHYLAMINE AND CYSTEINE TO PROTECT THE SILKWORM AGAINST THE MUTAGENIC AND LETHAL EFFECTS OF RADIATION. Yoshio Nakao, Yataro Tazima, and Takashi Sugimura (St. Paul's Univ.; Silk Science Research Inst; and Cancer Inst., Tokyo). Radiation Research 3, 400-6(1955) Dec.

RADIOTHERAPY

2000
METHOD AND PRACTICE OF THERAPY WITH SYNTHETIC RADIOISOTOPES. A. Jakob and J. Hiller. Strahlentherapie 98, 284-90(1955) Oct. (In German)

The authors describe practice and dosage of the possibilities of irradiation with radiocobalt, radioiridium, radioyttrium (radio-strontium), radio phosphorus, radio-tantalum, radiogold, and radiobismuth. The above mentioned radioisotopes are, according to the employed form of application, taken to the places concerned in a local or interstitial manner, or by means of the intermediary metabolism. The forms of application and the physical data are summarized in two tables. (auth)

2001
DOSAGE DISTRIBUTION IN MOVING FIELD THERAPY WITH A BETRATRON. J. Becker, R. Bloch, and F. Wachsmann. Strahlentherapie 98, 297-307(1955) Oct. (In German)

In answer to the recently voiced opinion that ultrahard rays make unnecessary the simultaneous application of moving field therapy, the authors point out the advantages of combining these two possibilities. The advantages are summarized. As regards the performance of moving field therapy, it is shown that, at 15 mv (dose at the irradiated surface = exit dose), pendular (arc) therapy, covering an angle of 180° is equivalent to rotation irradiations, covering 360°. (auth)

2002
AN AUTOMATIC CONTROLLED PATTERN CESIUM-137 TELETHERAPY MACHINE. Marshall Brucer (Oak Ridge Inst. of Nuclear Studies, Tenn.). Am. J. Roentgenol. Radium Therapy Nuclear Med. 75, 49-55(1956) Jan.

2003
CLINICAL STATIONARY FIELD THERAPY WITH A COBALT-60 UNIT. PART I. Gilbert H. Fletcher (Univ. of Texas and M. D. Anderson Hospital and Tumor Inst., Houston). Am. J. Roentgenol. Radium Therapy Nuclear Med. 75, 91-116(1956) Jan.

2004
CLINICAL STATIONARY FIELD THERAPY WITH A COBALT-60 UNIT. PART II. Gilbert H. Fletcher, Jasper E. Richardson, E. Bailey Moore, Jack M. Morgan, and Arthur Cole (Univ. of Texas and M. D. Anderson Hospital and Tumore Inst., Houston). Am. J. Roentgenol. Radium Therapy Nuclear Med. 75, 117-28(1956) Jan.

TRACER APPLICATIONS

2005 AECU-3132
[Minnesota. Univ., Minneapolis. University Hospital]. PROGRESS REPORT. PART I. [ISOTOPE ENCEPHALOMETRY]. PART II. PROGRESS AND PLANS IN THE DEVELOPMENT OF A SCANNING SCINTILLATION COINCIDENCE ISOTOPE-ENCEPHALOMETER. Lyle A. French and Ralph L. Suechting. Dec. 1955. 42p. Contract AT(11-1)-285.

Sixty-nine cases of suspected brain lesions were studied with both routine isotope encephalometry and the graphic method of analysis. Of thirty-two space occupying lesions, 68.7% were correctly diagnosed by both means, while 18.8% were negative with the routine method but were positive with the graphic method. The overall accuracy of locating a tumor when present was 87.5%. The proposed design for a scanning scintillation coincidence isotope-encephalometer is discussed. (C.H.)

2006 AECU-3135
Pittsburgh. Univ. Graduate School of Public Health. PROPOSAL FOR FURTHER STUDIES ON LUNG HAZARDS FROM INHALATION OF INSOLUBLE RADIOACTIVE PARTICULATE MATTER. Summary Report for year of July 15, 1953 to July 14, 1954. Herman Cember. [1955]. 9p. Contract AT(30-1)-912.

2007
REABSORPTION OF COBALT-60 FROM URINE AND BILE SAMPLES OF EXPERIMENTAL DOGS. Cheng-Chun Lee and L. F. Wolterink (Michigan State Univ. and Michigan Agricultural Experiment Station, East Lansing). Science 123, 65(1956) Jan. 13.

After intravenous injection of Co^{60} a form of Co^{60} other than its inorganic form was found in bile and urine samples collected from experimental dogs. The Co^{60} in the samples was reabsorbed from the gut of young chicks following injection into the gizzard at a considerably faster rate than inorganic Co^{60} was absorbed. (C.H.)

CHEMISTRY

2008 NYO-6590

Pennsylvania State Univ., University Park. Coll. of Chemistry and Physics.

GENERAL TRENDS IN THE STABILITIES OF COORDINATION COMPOUNDS. W. Conard Fernelius. Sept. 1955. 13p. Contract AT(30-1)-907.

Several generalizations have been made on the relative values of formation constants of coordination compounds. The sizes of the coordinating group and the metal ion appear to have an important influence on the stability of the resultant coordination compound. (C.W.H.)

2009 AERE-Lib/Trans-521

RESEARCHES INTO THE AGING OF HYDRATED OXIDES. A. Lottermoser and Eckhard Lottermoser. Translated by R. S. Forsyth from Kolloid-Beih. 37, 2-39(1933).

The aging of the gels of $Al(OH)_3$, $Cr(OH)_3$, $Fe(OH)_3$, $Co(OH)_2$, and $Ni(OH)_2$ was studied. Agglomeration and ordering velocities were estimated from sedimentation and powder analyses. (C.W.H.)

2010

RUTHENIUM(IV) NITRATES. J. S. Anderson and J. D. M. McConnell (Atomic Energy Research Establishment, Harwell, Berks, England). J. Inorg. and Nuclear Chem. 1, 371-7 (1955) Dec.

A solution of RuO_4 in HNO_3 is reduced by H_2O_2 to give a deep red solution. On evaporation to dryness, a dark red solid is obtained, which decomposes fairly rapidly. The properties of solutions of this solid, which are strongly acidic, are consistent with the hypothesis that it contains a series of hydroxo-aquo ruthenium complexes of quadrivalent ruthenium of the general formula $[Ru(OH)_x(H_2O)_{6-x}](NO_3)_{4-x}$. On neutralization with alkali there appears to be a slow polymerization process after $[Ru(OH)_3(H_2O)_3]NO_3$ has been formed, leading finally to a precipitate, probably hydrated RuO_2. (auth)

2011

NITRATO AND NITRO COMPLEXES OF NITROSYLRUTHENIUM. J. M. Fletcher, I. L. Jenkins, F. M. Lever, F. S. Martin, A. R. Powell, and R. Todd (Atomic Energy Research Establishment, Harwell, Berks, England). J. Inorg. and Nuclear Chem. 1, 378-401(1955) Dec.

A series of nitratoaquo nitrosylruthenium complexes, of general formula $[RuNO(NO_3)_y(OH)_{3-y}(H_2O)_2]$, has been identified. In aqueous solution they give rise to anionic and cationic ruthenium species; the higher nitrato complexes are hydrolyzed at room temperature at a rapid but measurable rate to lower nitrato complexes; condensation to polynuclear species accompanies these reactions. The trinitrato complex has been prepared by the action of boiling 8M HNO_3 on nitrosylruthenium hydroxide or the nitro complex $Na_2[RuNO(NO_2)_4OH]$ (hitherto considered a nitro complex of Ru(3+)), both of which are conveniently made from ruthenium chloride. Nitro and nitrato complexes of nitrosylruthenium are also formed from ruthenium tetroxide and ruthenium alloys by the action of nitrogen oxides or HNO_3. The stronger complexing of nitrosylruthenium by NO_2^- than by NO_3^-, as well as the degree of complexing of $RuNO^{3+}$ by ligands such as F^-, Cl^-, point to the general similarity of these coordination complexes to those of Co(3+) and Pt(4+). The nitrosylruthenium complexes are converted by sulfides to an insoluble nitrosylruthenium hydrosulfide. (auth)

2012

THE CATALYTIC HALIDES. XIII. THE INTERACTION OF GALLIUM TRICHLORIDE WITH ETHYL, ISOPROPYL, n-PROPYL, AND t-BUTYL CHLORIDES. Robert Wong and Herbert C. Brown (Purdue Univ., Lafayette, Ind.). J. Inorg. and Nuclear Chem. 1, 402-10(1955) Dec.

The phase diagrams for the $C_2H_5Cl-GaCl_3$ system were determined at four temperatures, −78.5, −64, −50, and −36°. A 1:1 addition compound exists in the solution phase as shown by molecular weight determinations. A solid phase corresponding to the 1:2 compound, $C_2H_5Cl:Ga_2Cl_6$, was identified, and the heat of dissociation, $C_2H_5Cl:Ga_2Cl_6(s) \rightleftharpoons C_2H_5Cl(g) + Ga_2(Cl_6(s)$ is 9.74 kcal/mole. The heat of solution of the 1:2 compound in C_2H_5Cl is 5.0 kcal/mole and the calculated m.p. is −29°C. The phase diagram for the isopropyl chloride–gallium chloride system was determined at −64°C. Solid phases corresponding to both the 1:2 and 1:1 compounds, $(CH_3)_2CHCl:Ga_2Cl_6$ and $(CH_3)_2CHCl:GaCl_3$, were identified. At higher temperatures, solutions of $GaCl_3$ in isopropyl chloride evolved HCl at an appreciable rate. Similar observations were obtained for solutions of gallium chloride in n-propyl and t-butyl chloride. Isomerization of n-propyl to isopropyl chloride was also observed. Under the same conditions the rate of hydrogen chloride evolution is t-butyl > isopropyl > n-propyl > ethyl chloride, which is also the order of stability of the carbonium ions of the respective alkyl groups. (auth)

2013

HEAT CAPACITY, HEATS OF FUSION AND VAPORIZATION, AND VAPOR PRESSURE OF DECABORANE ($B_{10}H_{14}$). George T. Furukawa and Rita P. Park. J. Research Natl. Bur. Standards 55, 255-60(1955) Nov.

Measurements of the heat capacity of decaborane ($B_{10}H_{14}$) were made from 55 to 380°K by means of an adiabatic calorimeter. The data were used to obtain a table of smoothed values of heat capacity, enthalpy, entropy, and Gibbs free energy from 60 to 380°K. (auth)

2014

PREPARATION OF TITANIUM TETRACHLORIDE OF HIGH PURITY. W. Stanley Clabaugh, Robert T. Leslie, and Raleigh Gilchrist. J. Research Natl. Bur. Standards 55, 261-4(1955) Nov.

A procedure is described for the preparation of $TiCl_4$ of high purity. Procedures are also given for determining the purity of $TiCl_4$ by cryoscopic, spectrochemical, and infrared absorption measurements. The triple-point temperature of pure $TiCl_4$ was found to be 249.045°K, with an estimated uncertainty of ±0.010°K. (auth)

ANALYTICAL PROCEDURES

2015 RMO-2506

Rohm and Haas Co. Research Labs., Philadelphia.

ELECTROLYTIC PRECIPITATION OF URANIUM FROM ION EXCHANGE ELUATES. Paul F. Kirk. May 27, 1952. Decl. Sept. 23, 1955. 21p. Contract AT(49-1)-535.

An electrolytic method has been investigated for the precipitation of uranium from typical eluates in ion exchange processes. The method, employing permselective, ion exchange membranes, recovers the elutant for re-

cycling and produces rapid-settling precipitates at very low power consumption. (auth)

2016 AEC-tr-2367

A NEW METHOD OF ELECTROANALYSIS. E. G. Tur'yan. Translated from Zavodskaya Lab., 21, No. 1, 17-20(1955). 5p. Available from Associated Technical Services (Trans. 45G8R), East Orange, N. J.

A method is described which permits accurate determination of quantities of organic and inorganic materials as small as 5×10^{-6} mole. The method is based on the electroreduction of the material on a mercury cathode with the simultaneous liberation of an equivalent quantity of iodine on a platinum anode. The electrolysis is continued until the material being determined has undergone complete electroreduction, as shown by a drop in the current intensity. The amount of the material is then determined by titrating the iodine liberated on the cathode with thiosulfate. The experimental arrangement is described, and results are presented from analyses of maleic acid, nitrobenzene, 2,5-dinitrophenol, picric acid, and 2,4-dinitrothiocyanobenzene. (M.P.G.)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

2017

ON SOME PHENOMENA OBSERVED ON THE OUTER SURFACE OF A TUNGSTEN MONOCRYSTAL IN ELECTRON MICROSCOPE PROJECTOR IN THE PRESENCE OF GASES. S. Z. Rogenskiĭ and I. I. Tret'yakov (Inst. of Phys. Chemistry). Doklady Akad. Nauk S.S.S.R. 105, 112-14 (1955) Nov. 1. (In Russian)

The photographic studies of separate organic molecules on the outer surface of metal monocrystals indicate a certain phenomena inducing an additional one-to-two factor image enlargement of the adsorption molecule. The recent investigations open new opportunities in direct observation of adsorption and chemical processes on the metal catalyst surface. Studies of the gas molecule effects on the electron microscope picture were made with oxygen, hydrogen, and helium. (R.V.J.)

Refer also to abstract 2034.

DEUTERIUM AND DEUTERIUM COMPOUNDS

2018

ISOTOPIC EFFECTS ON MUTUAL SOLUBILITY OF LIQUID DEUTERIUM COMPOUNDS. I. B. Rabinovich, V. D. Fedorov, N. P. Paskhin, M. A. Avdesnyak, and N. Ya. Pimenov. (Gor'kiĭ State Inst. of Chem.). Doklady Akad. Nauk S.S.S.R. 105, 108-11(1955) Nov. 1. (In Russian)

Investigation is made of isotopic effects on the mutual solubility of heavy water and deuterium organic compounds over a wide range of temperatures. (R.V.J.)

FLUORINE AND FLUORINE COMPOUNDS

2019 NP-5856

Stanford Research Inst., Menlo Park, Calif.

THE THERMODYNAMIC PROPERTIES OF MOLTEN SALTS. Bimonthly Progress Report for October-November. Report No. 5. Orlo E. Myers. Dec. 10, 1955. 7p. SRI Project No. CU-1102. Contract AF-33(616)-2558.

The objective of this research is to determine the absolute entropies, heats of formation, and free energies of formation of selected salts in the temperature range of 800 to 1900°F. New solution calorimetry measurements with MoO_3 lead to a final value of −390.9 kcal/mole for the heat of formation of liquid MoF_6 at 298.16°K. The desired thermodynamic functions for MoF_6 have been calculated and tabulated in a summary technical report. A new calorimeter has been constructed for low-temperature heat capacity determinations. Several attempts have been made to purify by distillation a quantity of NbF_5 which had been exposed to the air during shipment. (auth)

2020 WADC-TR-55-193(Pt.II)

Dow Corning Corp., Midland, Mich.

FLUORINE-CONTAINING POLYETHERS. [Period Covered] April 1955 to November 1955. Ogden R. Pierce, Donald D. Smith, and Robert M. Murch. Oct. 1955. 43p. Project Title: RUBBER, PLASTIC AND COMPOSITE MATERIALS. Task Title: SYNTHESIS AND EVALUATION OF NEW POLYMERS. Contract AF-33(616)-2417.

Investigations were continued on the following reactions: peracid oxidation and acid chloride reactions of fluorine-containing olefins; polymerization and vulcanization of 3,3,3-trifluoro-1,2-epoxypropane; and hypohalogenation of 3,3,3-trifluoro-2-methylpropene and 3,3,4,4,5,5,5-heptafluoro-1-pentene. Ethyl difluoroacetate was synthesized. (For preceding period see WADC-TR-55-193.) (C.W.H.)

GRAPHITE

2021 AECD-3679

Hanford Atomic Products Operation, Richland, Wash.

ABSORPTION PROPERTIES OF VIRGIN AND IRRADIATED GRAPHITE. C. N. Spalaris. Nov. 24, 1954. Decl. with deletions Oct. 5, 1955. 85p. Contract W-31-109-eng-52.

An investigation was made of the changes that take place on the surface of artificial graphite before and after exposure to radiation. Data are presented on the surface characteristics of the virgin graphite samples and the effects of radiation on the surface area, pore-size distribution, absolute density, temperature annealing effect, and the heat of adsorption of artificial graphite. The experimental findings are discussed. (C.H.)

2022 BMI-962

Battelle Memorial Inst., Columbus, Ohio.

EXPERIMENTAL CARBONS AND GRAPHITES FOR IRRADIATION STUDIES. W. A. Hedden, L. D. Loch, J. A. Slyh, and W. H. Duckworth. Oct. 26, 1954. Decl. Aug. 4, 1955. 46p. Contract W-7405-eng-92.

As part of a program to study the effect of the constitution of graphite on its stability under neutron irradiation, test specimens were made from a broad selection of raw materials and by a variety of fabrication and processing techniques. Data on the raw materials, techniques of fabrication, and properties of the test specimens are given in this report. The raw materials selected for study included the conventional, easy-graphitizing cokes, laboratory cokes made from commercial asphalts and pitches, carbon blacks, and cokes made from phenolic resins and cane sugar. The techniques used in processing the raw

materials, fabrication, and heat treatment were varied to produce test specimens having a wide range in physical properties and in structural characteristics. The bulk density of specimens was found to depend on type of filler, type of binder, and processing variables. Specimens having a bulk density as high as 1.82 g per cm^3 were made from a petroleum-coke filler bonded with a phenol formaldehyde resin, without the use of impregnants. Fifty-four groups of test specimens were submitted to Hanford for exposure to neutron irradiation. The effect of irradiation exposures, and correlations of radiation damage with properties of the specimens, will be given in a future report. (auth)

LABORATORIES AND EQUIPMENT

2023 NYO-6328

Pittsburgh. Univ.

AN ADIABATIC SPECIFIC HEAT CALORIMETER FOR THE RANGE 15°C TO 290°C. Progress Report for July 1, 1955 to October 1, 1955. W. E. Wallace, R. S. Craig, and W. V. Johnston. Oct. 21, 1955. 13p. Contract AT(30-1)-647.

Constructional details of an adiabatic specific heat calorimeter for the range 15 to 290°C are given. The calorimeter is designed for intermittent heating so that the specific heat characteristic of the sample in an equilibrium state is obtained. Precision of the order of 0.1 to 0.2% is attained over the entire temperature range. (auth)

2024 TID-5208(Suppl.1)

FOURTH ANNUAL SYMPOSIUM ON HOT LABORATORIES AND EQUIPMENT, HELD IN WASHINGTON, D. C., SEPTEMBER 29 AND 30, 1955. SUPPLEMENT 1. Jan. 1956. 123p.

Nine papers are presented covering the following subjects: electrical discharge machining for hot laboratories; radiation shielding; remote reactor manipulations; design of a storage safe and a cut-off wheel for hot laboratory use; tension testing of radioactive specimens; proposed methods for remote transfer of α and γ active materials into and out of high level caves; windows for remote viewing; the performance of radiation protected microscope objectives; and problems and costs encountered in the handling of irradiated fuels. (cf. TID-5208.) (C.H.)

RADIATION CHEMISTRY

2025 AECU-3077

Michigan. Univ., Ann Arbor. Engineering Research Inst.

THE REACTION OF CHLORINE WITH AROMATIC COMPOUNDS UNDER INTENSE GAMMA IRRADIATION. David E. Harmer. May 1955. 140p. Contract AT(11-1)-162. (ERI-1943-4-41-T)

The effect of γ radiation on the chlorination of certain aromatic compounds has been studied. Gamma radiation was found to be an outstanding promoter for the addition of chlorine to benzene. Radiochlorination of toluene and chlorobenzene proceeded rapidly, although not so fast as the benzene reaction. Results of the reactions and the inhibiting effects of benzyl chloride and oxygen are discussed. Possible explanations of the differences between the photochlorination and radiochlorination of the aromatic compounds are offered. (M.P.G.)

2026 IDO-16189

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

THE ORGANIC LOOP IN THE MTR GAMMA FACILITY DESIGN AND PRELIMINARY TEST. W. C. Francis. Aug. 11, 1954. Decl. Aug. 26, 1955. 46p. Contract AT(10-1)-205.

An organic fluid circulating loop has been constructed for installation in the MTR γ facility. The equipment was designed for circulating selected organic fluids, such as diphenyl, and terphenyl at γ intensities of 10^7 r/hr, temperatures up to 900°F, and velocities up to 20 ft/sec. The organic loop consists of an irradiation coil, pump, removable test sections, primary heat exchanger, pressurizing tank, liquid sampling tank, and various indicating and recording instruments. A secondary Dowtherm loop contains a pump, primary heat exchanger, secondary heat exchanger, and indicating instruments. Data to be obtained are: temperature; pressure; changes in heat transfer coefficient; flow characteristics, as evidenced by viscosity change; decomposition rate in terms of gas formation, pressure rise, and sample analysis; sludge deposition or corrosion, as determined by before and after examinations of heated and unheated surfaces. Initial operation of the equipment has disclosed serious limitations in pump operation. Packing leaks, galling, and low capacity of the pump necessitate its replacement if design conditions are to be met. (auth)

2027

HYDROGEN PEROXIDE YIELDS IN X-IRRADIATED AQUEOUS SOLUTIONS. A SENSITIVE METHOD BASED ON HYDRAZIDE CHEMILUMINESCENCE. W. V. Mayneord, W. Anderson, H. D. Evans, and D. Rosen (Royal Cancer Hosp., London). Radiation Research 3, 379-92(1955) Dec.

The chemiluminescence from certain reactions of cyclic hydrazides, previously studied only by visual observations, has been measured with sensitive photomultiplier methods. A relationship has been found showing that the total light emitted from reactions of phthalic hydrazide with hydrogen peroxide is proportional to $[H_2O_2]^{1.7}$. The results are briefly discussed in relation to present theory of hydrazide chemiluminescence. The light emitted from these reactions has been used in a method of estimation of hydrogen peroxide at levels as low as 0.005 μg/ml ($\sim 10^{-7}$ M). The method can be used to determine the hydrogen peroxide produced in aerated water (1 to 2 ml) after x irradiation at dose levels down to 100 r. The results of a preliminary application of the method to the estimation of hydrogen peroxide yields from x irradiation of some aerated aqueous solutions are described. (auth)

2028

THE MECHANISM FOR THE DEGRADATION OF CYSTAMINE BY IONIZING RADIATION. B. Shapiro and L. Eldjarn (Norwegian Radium Hosp., Oslo). Radiation Research 3, 393-9(1955) Dec.

In order to test the hypothesis that the degradation of cystamine by ionizing radiation was produced by radicals and hydrogen peroxide formed from the water of the solution, pure, dry, S^{35}-labeled cystamine was irradiated by Co^{60}. Analysis of this material by paper chromatography did not reveal the 2-aminoethane sulfinic acid or taurine found after irradiation of cystamine solutions. The chemical production of the radicals OH and HO_2 in solutions contain-

ing cystamine did result in formation of 2-aminoethane sulfinic acid and taurine. The addition of hydrogen peroxide to cystamine solutions also yielded these two products. By treating aqueous solutions of cystamine prior to irradiation it was possible to obtain a predominance or depression of one or two of the radicals and hydrogen peroxide. The results demonstrated the effect of each oxidizing agent in the production of 2-aminoethane sulfinic acid and taurine from cystamine. A tentative diagram of the pathways of cystamine degradation by ionizing radiation was presented. (auth)

2029

THE EFFECT OF IONIZING RADIATION ON AMINO ACIDS. IV. pH EFFECTS ON THE RADIATION DECOMPOSITION OF ALANINE. Norman E. Sharpless, Alberta E. Blair, and Charles R. Maxwell (National Insts. of Health, Bethesda, Md.). Radiation Research 3, 417-22(1955) Dec.

2030

REACTIONS OF Br^{80}(18 min) PRODUCED BY ISOMERIC TRANSITION OF Br^{80m}(4.58 hr) WITH BENZENE AND METHYLATED BENZENES. T. A. Carlson and W. S. Koski (Johns Hopkins Univ., Baltimore). J. Chem. Phys. 23, 2410-14(1955) Dec.

The reactions of benzene, toluene, para- and ortho-xylene, and mesitylene with Br^{80} as a result of isomeric transition have been studied. It was found that the reactions were complex. The substitution reaction was accompanied by condensation reactions. Evidence was found that organic bromides with boiling points higher than bromobenzene were formed in appreciable yields. Hydrolysis experiments indicated that both primary and secondary bromides were included in these high boiling compounds. Scavenger experiments indicated that the substitution reactions were proceeding in the main through fast bromine atom reactions. No evidence was obtained that any appreciable amounts of the substitution reactions were proceeding through a positive bromine ion mechanism. (auth)

RADIATION EFFECTS

2031

CHEMICAL AND PHOTOCHEMICAL STUDIES ON 6,8-THIOCTIC ACID AND 1,2-DITHIOLANE (TRIMETHYLENE DISULFIDE). R. B. Whitney and Melvin Calvin (Univ. of California, Berkeley). J. Chem. Phys. 23, 1750-6(1955) Oct.

Quantum yields have been determined in the photolysis of thioctic acid and trimethylene disulfide by ultraviolet light under varied conditions of concentration, light intensity, wave length, and acidity. The order of magnitude of the quantum yield is unity. (auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

2032

HEAT CAPACITY OF ERBIUM FROM 15 TO 320°K. R. E. Skochdopole, Maurice Griffel, and F. H. Spedding (Iowa State Coll., Ames). J. Chem. Phys. 23, 2258-63(1955) Dec.

The heat capacity of Er has been measured over the range 15 to 320°K and the thermodynamic functions have been calculated. Three maxima have been observed which occur at 19.9, 53.5, and 84°K. The two at the lower temperatures show a dependence on the thermal history of the sample, and this dependence was investigated. A correlation of the various contributions to the entropy at room temperature has been made and extended to the other rare earth metals. (auth)

2033

PRESSURE-TEMPERATURE-COMPOSITION STUDIES OF SOME RARE EARTH/HYDROGEN SYSTEMS. Robert N. R. Mulford and Charles E. Holley, Jr. (Los Alamos Scientific Lab., N. Mex.). J. Phys. Chem. 59, 1222-6(1955) Dec.

Pressure-temperature-composition data are presented for the La, Ce, Pr, and Nd-H_2 systems in the ranges T = 150 to 800°, p = 0.01 to 400 mm. It is concluded that La, Ce, Pr and Nd all behave similarly with H_2, exhibiting two solid phases, metal and a hydride phase, for compositions between M and MH_2, and a single solid hydride phase for compositions between MH_2 and approximately MH_3. (M = La, Ce, Pr or Nd.) In the latter range, composition is dependent on temperature and pressure. The heats of formation of the MH_2 hydride phases, as obtained from the pressure-temperature measurements are: LaH_2, 49.7; CeH_2, 33.9; PrH_2, 47.8; and NdH_2, 44.8, kcal. per mole of H_2. The equations for the dependence of decomposition pressure on temperature are: for LaH_2: $\log_{10} p = 10.758 - 10858/T$; for CeH_2: $\log_{10} p = 7.708 - 7417/T$; for PrH_2: $\log_{10} p = 10.229 - 10446/T$; for NdH_2: $\log_{10} p = 9.370 - 9796/T$, pressures in mm. of mercury, temperatures in degrees Kelvin. The heats and equations are actually for the process xM (sat. with H_2) + H_2 = xMH_2 (sat. with metal). The saturation solubilities vary with temperature. (auth)

2034

THE CRYSTAL STRUCTURE OF SOME RARE EARTH HYDRIDES. C. E. Holley, Jr., R. N. R. Mulford, and F. H. Ellinger (Los Alamos Scientific Lab., N. Mex.), W. C. Koehler (Oak Ridge National Lab., Tenn.), and W. H. Zachariasen (Univ. of Chicago). J. Phys. Chem. 59, 1226-8 (1955) Dec.

La, Ce, Pr, Nd, and Sm form an isomorphous series of hydrides of composition MH_2 to MH_3. X-ray and neutron diffraction data have shown that the MH_2 hydrides have the fluorite-type structure and that the additional hydrogen in the $MH_{>2}$ compositions is statistically distributed in the octahedral interstices of the fluorite structure. The unit cube of the hydride contracts as it takes up hydrogen. (auth)

SEPARATION PROCEDURES

2035 RMO-2508

Rohm and Haas Co. Research Labs., Philadelphia.

ELECTROLYTIC RECOVERY OF MANGANESE FROM BARREN LEACH LIQUORS. Paul F. Kirk. Aug. 22, 1952. Decl. Sept. 23, 1955. 13p. Contract AT(49-1)-535.

An electrolytic method has been investigated for the recovery of Mn from typical barren liquors. This method, employing permselective, ion exchange membranes, gives a high-grade Mn product at excellent recovery levels. The process also is capable of producing large quantities of H_2SO_4 for leaching as well as O_2 which can be used for the reoxidation of the manganese precipitate. (auth)

2036 RMO-2526

Rohm and Haas Co. Research Labs., Philadelphia.

THE ELECTROLYTIC MIGRATION OF URANIUM FROM

ACID LEACH LIQUORS BY MEANS OF ION EXCHANGE MEMBRANES. Norman W. Frisch. Aug. 3, 1953. Decl. Sept. 23, 1955. 10p. Contract AT-(49-1)-535.

Research on the electrolytic migration of U from acid leach liquors was undertaken in order to note the effect of certain operational variables on the economics of U recovery. Among the variables studied were the type of supporting electrolytes (anolyte and catholyte), ratio of U to SO_4^{-2} concentration in leach liquor, flow rate of leach liquor, current density, and the effect of metallic ions in leach liquor. The studies were conducted in a 3-compartment cell, using anion permeable membranes. The highest U recoveries were noted using $MgSO_4$ catholyte and catholytes containing a mixture of $MgSO_4 - Mg(OH)_2$. (J.E.D.)

2037 RMO-2527

Rohm and Haas Co. Research Labs., Philadelphia.
FURTHER STUDIES ON THE RECOVERY OF URANIUM FROM SULFURIC ACID LEACH SOLUTIONS BY ANION EXCHANGE RESINS. Al Preuss, Charles Dickert, and Jean Saunders. Dec. 4, 1953. Decl. Sept. 23, 1955. 25p. Contract AT-(49-1)-535.

The use of ion exchange resins in the recovery of uranium from sulfuric acid leach solutions has been established. At the present time all resins in use are of the strong base type with quaternary structures. The present investigation deals with a screening of resins employing tertiary, mixed tertiary-quaternary and quaternary groupings incorporated into the resin structure. Two resins were selected for extensive study. (auth)

2038 RMO-2611

Little (Arthur D.) Inc. Western Labs., San Francisco.
ELECTROLYSIS OF CARBONATE LEACH SOLUTIONS. J. C. Huggins, R. A. Carlson, and I. F. Schwien. Oct. 13, 1954. Decl. Aug. 18, 1955. 37p. Contract AT(49-6)-923.

A summary of batch studies performed on the electrolytic reduction and precipitation of uranium and vanadium in carbonate solutions is presented. Results from studies of operating variables show that the most efficient reduction can be realized when hot solutions containing a high vanadium concentration are electrolyzed at low cathode current densities. In general, for a given percent precipitation, the current efficiency is inversely proportional to the logarithm of the cathode current density. Various cathode materials were tried and it was found that only mercury or amalgamated copper were satisfactory cathodes for the reduction of vanadium. Since a diaphragm is required to prevent the soluble +4 vanadium from contacting the anode where it would be oxidized, tests were conducted to determine the best material for use as a diaphragm. These tests show that either nylon of very close weave or an ion-exchange membrane would be the most suitable diaphragms for the cells. In order to develop a prototype for a pilot plant or production cell, various types of cells were constructed and operated. Results indicated that a vertical diaphragm cell with catholyte agitation would be the preferred type. Data on the reduction of synthetic carbonate solutions containing only uranium are presented which may be of interest in connection with solutions derived from Grants Ore. (auth)

2039

ADSORPTION STUDIES ON CLAY MINERALS. V. MONTMORILLONITE–CESIUM–STRONTIUM AT SEVERAL TEMPERATURES. George L. Gaines, Jr. and Henry C. Thomas (Yale Univ., New Haven, Conn.). J. Chem. Phys. 23, 2322-6(1955) Dec.

Ion-exchange equilibria for the pair Cs-Sr between aqueous chloride solutions and a montmorillonite clay have been studied in the temperature range 5 to 75°. Data from chromatographic elution experiments have been found to be unreliable because of nonequilibrium effects, and a method independent of rate behavior has been applied. From the data obtained, equilibrium constants, solid-phase activity coefficients, heat content, and entropy changes for the reaction have been evaluated. (auth)

Refer also to abstracts 2044, 2045, and 2049.

SORPTION PHENOMENA

2040

INVESTIGATIONS OF THE SURFACE CONDENSATION AND ADSORPTION OF VAPORS NEAR THE SATURATION POINT BY OPTICAL AND MICROPOLARIZATION METHOD. II. B. V. Deryagin and Z. M. Zorin. (Moscow Inst. of Chemical Physics). Zhur. Fiz. Khim. 29, 1755-76(1955) Oct. (In Russian)

A study using the optical and micropolarization method was made with aliphatic alcohols, carbon tetrachloride, benzene, nitrobenzene, caproic acid, n-pentane and n-heptane on K-8 glass and flint glass. (R.V.J.)

TRACER APPLICATIONS

2041

INVESTIGATION OF ACTION MECHANISM OF THE ANTICORROSION ADMIXTURES TO OILS BY THE RADIOACTIVE INDICATOR METHOD. Yu. S. Zaslavskiĭ, S. E. Kleĭn, and R. N. Shneerova. Zhur. Fiz. Khim. 29, 1815-21(1955) Oct. (In Russian)

Radiosulfur (S^{35}) and radiophosphorus (P^{35}) were used in anticorrosive admixtures to the mineral oil. The results of the study proved that a protective film forms over a metal with the help of the S or P as the basic components of the admixture. The formation of the protective film in relation to time, temperature of oil, concentration of the admixture, and the metal surfaces was established. Also, the complicated process of film formation, adsorption, and chemical interaction is given. It was suggested that adsorption processes take place at lower temperatures. While chemical interactions prevail at high temperatures during which the S penetrates the metal and the transfer of the metal into the oil occurs as a result of this chemical interaction. (R.V.J.)

TRANSURANIC ELEMENTS AND COMPOUNDS

2042 ANL-5361

Argonne National Lab., Lemont, Ill.
PRODUCTION OF Pu^{246} IN THE MTR. Herbert Diamond and Raymond F. Barnes. Nov. 1954. Decl. Sept. 23, 1955. 6p. Contract W-31-109-eng-38.

Pu^{246} and its β^- decay product, Am^{246}, have been detected in a Pu–Al alloy irradiated in the core of the materials testing Reactor for 600 days. The separation of Pu^{246} from fission products and of Am^{246} from Pu^{246} is described. The half lives of the isotopes were measured

and were in good agreement with previously reported values. The MTR neutron capture cross section for formation of Pu^{246} from Pu^{245} was measured as 260 ± 145 barns. (M.P.G.)

Refer also to abstract 2074.

URANIUM AND URANIUM COMPOUNDS

2043 ACCO-38 (Suppl.)

American Cyanamid Co. Atomic Energy Div. Raw Materials Development Lab., Winchester, Mass.

SUPPLEMENT TO PROGRESS REPORT ON THE FLOTATION OF URANIUM BEARING MINERALS FROM LAKE ATHABASKA ORE, SAMPLE 43-1. J. B. Breymann, III. Dec. 28, 1953. Decl. Dec. 21, 1955. 3p. Contract AT-(49-1)-533.

The amount of U lost in solution during flotation in an acid circuit is discussed. The use of octylorthophosphoric acid (OPA) as a collector in the presence of Na silicofluoride resulted in buffering at a pH above 5.5. The U_3O_8 soluble losses were negligible. (C.H.)

2044 DOW-138

Dow Chemical Co. Western Div., Pittsburg, Calif.

PROGRESS REPORT [FOR] NOVEMBER–DECEMBER 1955. Research Dept. R. H. Bailes. Jan. 1, 1956. 28p. Contract AT-30-1-GEN-236.

Studies of the recovery of U from plateau ores by solvent extraction of aqueous leach liquors and slurries with organic phosphate solutions and by non-aqueous leaching with organic leach solutions are presented. (For preceding period see DOW-136.) (auth)

2045 ISC-612

Ames Lab., Ames, Iowa.

RECOVERY OF URANIUM FROM SUPERPHOSPHATE. A. W. Andresen and G. L. Bridger. June 1955. 65p. Contract W-7405-eng-82.

Uranium can be recovered from superphosphates by a single-step liquid-slurry extraction of the freshly acidulated phosphate rock with actyl pyrophosphoric acid in kerosene as the solvent. Limiting factors in the process are extent of apatite lattice destruction and possible UF_4 formation during acidulation. (C.W.H.)

2046 Y-1087

Carbide and Carbon Chemicals Co. Y-12 Plant, Oak Ridge, Tenn.

GAMMA COUNT ESTIMATION OF ENHANCED URANIUM CONCENTRATION IN SOLUTIONS. W[illiam] B. Wright, Jr., R. C. McIlhenny, and J[ohn] W. Wachter. Sept. 1, 1954. Decl. Oct. 11, 1955. 15p. Contract W-7405-eng-26.

The rapid estimation of enhanced uranium concentration in solution is possible by counting the 0.19 Mev gamma of U^{235} with a scintillation detector. The count rate is a linear function of the U concentration at a constant ratio of U isotopes. By using the discriminator circuit of a linear amplifier, correction for the presence of a high energy gamma-active impurity may be made. The method has a lower limit of accurate detection of about 50 ppm of enhanced U in a sample volume of about 500 ml. (See also Y-1080.) (auth)

2047

HIGH-TEMPERATURE X-RAY STUDY OF URANIUM OXIDES IN THE UO_2–U_3O_8 REGION. Fredrik Grønvold (Universitetet i Oslo, Blindern, Norway). J. Inorg. and Nuclear Chem. 1, 357-70(1955) Dec.

Uranium oxides in the UO_2–U_3O_8 range have been studied by the x-ray powder method at temperatures between 20 and 969°C after annealing at 1000°C. The following phases were found: UO_{2+x} with no detectable range of homogeneity at room temperature, $UO_{2.25}$ or U_4O_9 with a narrow range, and U_3O_{8-x} with a range between $UO_{2.52}$ and $UO_{2.667}$. (auth)

Refer also to abstract 2074.

ENGINEERING

2048 HW-34079(Rev.)

Hanford Atomic Products Operation, Richland, Wash.

DENSITY DETERMINATIONS FOR RADIOACTIVE MATERIALS. G. R. Mallett. Dec. 10, 1954. 17p. Contract W-31-109-Eng-52.

Pycnometric, volumetric, and hydrostatic methods are described for determining the density of radioactive materials. A schematic drawing and photographs are included of the shielded density cell used in the measurements. A density-temperature curve for one-octanol illustrates the relationship between literature values and determined values using a stainless steel standard. (C.H.)

2049 AERE-Lib/Trans-617

THE STATE OF THE DEVELOPMENT AND APPLICATION OF HYDROCYCLONES. F. J. Fontein. Translated by J. B. Sykes from Chem. Ing. Tech. 27, 190-2(1955).

Several uses including sizing by sedimentation and washing of crude coal are outlined for single and multiple hydrocyclones. Equipment descriptions are included. (C.W.H.)

2050

CHART COMPARES VESSEL DESIGN THEORIES. R. W. Schneider (Travelers Insurance Co., Hartford, Conn.). Chem. Eng. 63, No. 1, 218(1956) Jan.

Graphs of S(stress)/P(pressure) vs. K(ratio of outside to inside diameter) are presented for an intercomparison of the following design theories: maximum shear; maximum distortion energy; St. venant; maximum principal stress (Lamé); ASME code; and membrane. (C.W.H.)

HEAT TRANSFER AND FLUID FLOW

2051 AERE-T/R-1718

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE STRUCTURE OF MAGNETROHYDRODYNAMIC SHOCKS. W. Marshall. July 1955. 40p.

The structure of a plane shock in an ionized gas in the presence of a magnetic field which is perpendicular to the line of flow is examined theoretically. It is shown that the nature of the flow depends upon the magnitude of a parameter β which is determined by the electrical conductivity, i.e. by the temperature and number density of electrons, in the undisturbed gas. An interesting effect which occurs for ordinary (H = 0) shocks taking place in an ionized gas but not for ordinary shocks in an unionized gas is discussed. (auth)

2052 BMI-1026
Battelle Memorial Inst., Columbus, Ohio.
HEAT TRANSFER FROM PARALLEL RODS IN AXIAL FLOW. David A. Dingee, Wayne B. Bell, Joel W. Chastain, and Sherwood L. Fawcett. Aug. 5, 1955. 51p. Contract W-7405-eng-92.

An investigation of the heat-transfer and pressure-drop characteristics of heated rods in axial flow with water as coolant is described. Three ratios of center-to-center spacing to rod diameters, 1.12, 1.20, and 1.27, in both the square- and triangular-pitch array, were tested at two Prandtl numbers, 1.18 and 1.75, over a range of Reynolds numbers from about 3×10^4 to 6×10^5. The magnitude of the peripheral variation of the heat-transfer coefficient was found to be of the same order of magnitude as the experimental error, which is about 8% of reported values. The variation of the heat-transfer coefficient down the length of the rod was found to be negligible under the assumption of no transverse mixing of the fluid within an array, which is believed to be the case. The experimental Nusselt numbers fall either on or very close to the equation: $Nu = 0.023\ Re^{0.8}Pr^{1/3}$, depending on the particular geometry of the test model. The square-pitch array showed slightly better heat-transfer characteristics than the triangular pitch. Likewise, the larger spacing-to-diameter ratios showed improved heat-transfer characteristics. These geometric changes varied the heat-transfer properties about 15% from the extremes in the range considered. Friction factors for all of the test section showed satisfactory agreement with the standard correlation curve for smooth pipes. (auth)

2053 BNL-203
Brookhaven National Lab., Upton, N. Y.
HEAT TRANSFER RATES FOR CROSS FLOW OF WATER THROUGH A TUBE BANK AT HIGH REYNOLDS NUMBERS. O. E. Dwyer, F. L. Horn, R. T. Schomer, T. V. Sheehan, and J. Weisman. Nov. 20, 1952. Decl. Sept. 26, 1955. 76p. Contract AT-30-2-GEN-16.

Film heat transfer coefficients have been obtained for cross flow of water through a tube bank under the following conditions: tube size, 0.810-in. OD; tube length, 12 in.; tube spacing, $1^9/_{32}$-in. equilateral pitch; lattice size, 10 tubes wide × 20 tubes long; bulk water temperature, 360°F; maximum number of active elements, 3; maximum temperature rise of water, 0.4°F/pass. Average heat transfer coefficients, on an individual tube basis, have been determined for various positions in the lattice. It is evident that the tubes near the front of the lattice showed average film coefficients appreciably lower than those for the rest of the lattice. It is worth noting that for the tubes in the front row b = 0.65, whereas for all other tubes tested it was 0.8. This is in qualitative agreement with some previous results for cross flow of air to staggered tube banks, which showed lower coefficients for the first row of tubes. Apparently, at the fourth row, the heat transfer characteristics are much the same as for the succeeding rows. It is also evident that the tubes near the side walls have higher average film coefficients (generally to 15%) than the tubes in the interior of the lattice. (auth)

2054 BNL-2446
Division of Engineering, AEC. and Brookhaven National Lab., Upton, N. Y.
REACTOR HEAT TRANSFER INFORMATION MEETING HELD AT BROOKHAVEN NATIONAL LABORATORY, OCTOBER 18–19, 1954. Dec. 1955. 195p.

The following unclassified papers were presented at the Reactor Heat Transfer Information Meeting in October, 1954: Heat Transfer Rates to Cross-Flowing Mercury in a Staggered Tube Bank; Specific Heat of Liquid Metal and Salt Mixtures; The Effect of Gas Entrainment on the Heat Transfer Characteristics of Liquid Mercury; Flow in a Thermal Convection Harp in the Grashof Modulus Range From 10^4 to 10^6; Theoretical and Experimental Investigation of Heat Transfer by Laminar Natural Convection Between Parallel Plates; Remarks on Forced Heat Convection in Cylindrical Channels; Potential and Parabolic Velocity Distributions; High Temperature Liquids; Heat Transfer to Boiling Water Forced Through an Electrically Heated Tube; Boiling Density Studies in Multiple Rectangular Channels; Measurement and Prediction of Density Transients in a Volume-Heated Boiling System; Heat Transfer and Corrosion Tests for a Sodium-Cooled Fast Breeder Reactor; and Free Convection in Narrow Vertical Liquid Metal Annuli. (M.P.G.)

MATERIALS TESTING

2055 NP-5857
Standard Oil Co. of Indiana, Whiting.
DEVELOPMENT AND EVALUATION OF HIGH TEMPERATURE GREASES. Quarterly Progress Report No. 16. Parts I and II. Edward A. Swakon, Delmar D. Krehbiel, Morton Z. Fainman, and Kemp R. Bunting. Apr. 1955. 23p. Contract AF33(038)-23687.

Monthly Progress Report No. 47 is incorporated with this report and will not be submitted separately.

Parts I and II were issued separately but are cataloged as a unit.

Progress is reported on the development and evaluation of wide-temperature-range greases suitable for use from −65° to 450°F and above. The chief criteria of laboratory evaluation are performance in the ABEC-NLGI Bearing Tester, Navy Gear-Wear Tester, and linear screw-and-nut actuator. Arylurea-silicone greases continue to perform longer in bearing tests in the temperature range from 425 to 600°F than silicone greases of other materials such as copper phthalocyanine and pteridines. Arylurea-esters greases have performed 2 to 5 times longer than soap-ester greases of the MIL-G-3278 variety in bearing tests at 350°F and in actuator tests at 375°F. (For preceding period see NP-5674.) (auth)

MINERALOGY, METALLURGY, AND CERAMICS

CORROSION

2056 BMI-951
Battelle Memorial Inst., Columbus, Ohio.
CORROSION OF THORIUM AND THORIUM BINARY ALLOYS IN DISTILLED WATER AT 100 AND 200°C. W. E. Berry, H. A. Pray, and R. S. Peoples. Sept. 29, 1954. Decl. Sept. 30, 1955. 18p. Contract W-7405-eng-92.

The corrosion behavior of Th and several of its alloys in distilled water was studied. Unalloyed Ames Th was found to possess excellent corrosion resistance in boiling distilled water. Thorium alloyed with Zr was equally resistant; however, additions of Al, Cr, Pb, Mo, Ni, Nb, Si, Ti, or V either lowered or completely destroyed its corrosion resistance. Neither unalloyed Th nor any of the above alloys were resistant to water at 200°C. Alloys containing Ti or Zr exhibited less attack than unalloyed Th, and their corrosion resistance increased as alloy content increased. Raising the test temperature from 100 to 200°C increased corrosion rates as much as 1000-fold. (auth)

2057 BMI-1041

Battelle Memorial Inst., Columbus, Ohio.

REACTION OF NICKEL IN MOLTEN SODIUM HYDROXIDE. Robert S. Peoples, Paul D. Miller, and H. Dale Hannan. Sept. 27, 1955. 13p. Contract W-7405-eng-92.

The final experimental results are presented from a study of several phases of the nickel–sodium hydroxide system. It was shown that sodium oxide is a product of the reaction of nickel and sodium hydroxide at 950°C under either an argon or a hydrogen atmosphere. A discussion of the role of sodium oxide in the corrosion mechanism is given. A more detailed study of the nickel–sodium hydroxide system at 950°C under argon confirms the cyclic corrosion process suggested previously. A study of this system at 816°C has shown that at this lower temperature the corrosion is approximately half as severe as at 950°C for a given time interval. Details of the reduction procedure used for analysis of the residues are given. The results of these reductions have not provided a reasonable formula for the needlelike crystals found in the leached residues. (auth)

2058 KAPL-1376

Knolls Atomic Power Lab., Schenectady, N. Y.

CORROSION OF IRON IN HIGH-TEMPERATURE WATER. I. CORROSION RATES BY HYDROGEN EVOLUTION AT 240 TO 360°C. II. KIRKENDALL EXPERIMENTS. D. L. Douglas and F. C. Zyzes. Nov. 1, 1955. 93p. Contract W-31-109-Eng-52.

A new method of measuring the corrosion rate of metals in high-temperature water was developed. The method involves determining the amount of H_2 evolved in the reaction. Corrosion measurements are carried out in small autoclaves, the gas space of which is filled with a known amount of a carrier gas, helium. After corrosion, a sample of the gas is taken, and is analyzed on the mass spectrometer. From the analysis and the amount of gas the H_2 evolved in the corrosion reaction is readily calculated. Using this method, extensive measurements were made of the corrosion of Armco Fe and high-purity Fe over the temperature range 240 to 360°C. The effects of surface finish, temperature, and heat-treatment were studied. In addition, measurements were made in saturated vapor, superheated vapor, and certain dilute aqueous solutions. Electrolytically or chemically polished surfaces corrode at a rate that is very low compared with the rougher pickled surfaces. At 240°C the corrosion rate is low and constant with time. At 316°C and 360°C the corrosion behavior is best described by the cubic law, $m = k_1 (t + k_2)^{1/3} + k_3$, where m is the amount of H_2 evolved, t is the time, and k_1, k_2 and k_3 are constants. An unexplained spread in the data prevented the determination of the constants, but the total corrosion for electropolished specimens ranged from about 0.5 to 1.0 millimoles of H_2 evolved per square decimeter in 500 hours. No significant difference between Armco Fe and the high-purity Fe was found. Also, no effect of temperature in the range 316 to 360°C was detected. Corrosion behavior is the same in saturated vapor, superheated vapor, and the dilute solutions. Annealing the Fe for a few hours at 800°C in H_2 or a vacuum somewhat increased the corrosion rate. These results are discussed in terms of a mechanism involving diffusion of Fe ions through a magnetite film. At 240°C the rate-determining step is postulated to a Schikorr-type reaction, $3\ Fe(OH)_2 \rightarrow Fe_3O_4 + H_2 + 2\ H_2O$. At the higher temperatures iron ion diffusion is likely to be rate-determining. Kirkendall-type experiments were carried out in order to identify the ion species diffusing through the magnetite film formed on corrosion of Fe in high-temperature water. Iron disks were painted with a slurry of $Ni^{63}O$, and the surface activity was measured. After corrosion the activity decreased. This decrease is shown to be most readily explained by a covering of $Ni^{63}O$ by magnetite formed as Fe ions diffuse outward from the metal–oxide interface to the oxide–water interface. (auth)

2059 LRL-76

California Research and Development Co. Livermore Research Lab., Livermore, Calif.

MASS TRANSFER OF FOREIGN ELEMENTS FROM ZIRCONIUM DURING HIGH-TMPERATURE WATER CORROSION. L. M. Litz, S. A. Ring, W. R. Balkwell, and R. D. Nethaway. Jan. 1954. Decl. Sept. 29, 1955. 19p. Contract AT(11-1)-74.

The mass transfer of Nb, Zr, Y, Sr, Rb, Se, As, and Ge from Zr metal foils was followed during water corrosion of the Zr at 264, 280, and 300°C, using radioactive tracers of these elements. Diffusion appears to be the predominant transfer process with a decrease in diffusion rate as the corrosion film increases in thickness. Approximate diffusion coefficients were calculated. (auth)

2060 AEC-tr-2364

OXIDATION AND CORROSION PROCESSES AT MEDIUM AND LOW TEMPERATURES. Karl Hauffe. Translated from Werkstoffe u. Korrosion, 6, 117-30(1955). 25p. Available from Associated Technical Services, (Trans. 93G7G) East Orange, N. J.

An interpretation of the oxidation and corrosion processes occurring at low and medium temperatures in metals is presented. Chemisorption and the formation of lattice defects in ionic crystals are discussed. (C.W.H.)

2061

DISCUSSIONS ON CATALYTIC CORROSIONS. S. Z. Roginskii, I. I. Tret'yakov, and A. B. Shekhter. (Moscow Inst. of Physical Chem.). Zhur. Fiz. Khim. 29, 1921-3 (1955) Oct. (In Russian)

A review is given of the results obtained in electron microscope studies of the corrosive effects on the surfaces of massive metals appearing during catalysis, chemical sorption, or heat treatments. The electron microscopic pictures of catalytic corrosion effected on the palladium and platinum surfaces by hydrogen or ammonium oxidations under various thermal or time working conditions are demonstrated. Also, an illustration of Zn oxide crystals with

blown-on layers of Au and Pt + 10% Rh oxidation pictures are given. 20 references. (R.V.J.)

Refer also to abstracts 2072 and 2077.

GEOLOGY AND MINERALOGY

2062 ORO-143

Tennessee. Univ., Knoxville.
AN INVESTIGATION OF THE CHATTANOOGA BLACK SHALE OF TENNESSEE AS A SOURCE OF URANIUM. Progress Report [for] January 1, 1955 to June 30, 1955. Paris B. Stockdale. July 1, 1955. 11p. Contract AT-(40-1)-1337.

The primary aim of the investigation was to obtain a complete geologic picture of the Chattanooga shale in the outcrop area of the Eastern Highland Rim and Northern Highland Rim of Tennessee and in a small area of adjoining Kentucky. Especial emphasis was placed upon stratigraphic relationships and associated special problems, and their implications in turn upon the age and manner of origin of the sediments and upon the origin, source, and distribution of the uranium in the shale. Both field and laboratory studies have been involved. (auth)

2063 RME-79

Grand Junction Operation Office, AEC., Colo.
URANIUM DEPOSITS IN THE MORRISON FORMATION, CHURCH ROCK AREA, MCKINLEY COUNTY, NEW MEXICO. John V. A. Sharp. May 1955. 19p.

An investigation of the uranium deposits in the Morrison formation in the Church Rock area northeast of Gallup, New Mexico was conducted during the summer of 1953. Two deposits of uranium minerals were known in the Westwater sandstone member of the Morrison formation prior to the beginning of field work; two others were discovered during the course of the field work. On the basis of color and lithology the lower member of the Morrison formation, the Recapture Creek shale—Cow Springs sandstone, was found to be unfavorable for the presence of uranium minerals in significant quantities. The Brushy Basin member of the Morrison formation contains sandstone lenses that are thought to be favorable for uranium occurrences. Other Westwater and Brushy Basin deposits of northwestern New Mexico are discussed in connection with the Morrison deposits of the Church Rock area. The presence of uranium is attributed to precipitation from descending uraniferous solutions in sandstone above impermeable mudstone layers. The overlying uraniferous Dakota formation is thought to be the immediate source of the mineralizing solutions. Two practical ore guides have been developed for the Westwater member. (auth)

2064 RME-3107

Washington and Lee Univ., Lexington, Va.
REPORT OF RADIOMETRIC RECONNAISSANCE IN VIRGINIA, NORTH CAROLINA, EASTERN TENNESSEE, AND ALABAMA. Marcellus H. Stow. Feb. 1955. 33p. Contract AT(49-1)-860, Mod. No. 1-4.

Reconnaissance for areas of anomalous radioactivity was conducted in Virginia, North Carolina, the two counties in northeastern Tennessee, and a few selected areas of South Carolina, Georgia, and Alabama. Approximately 10,000 miles of road traverse was made with scintillation counter supplemented with Geiger counter at localities showing anomalous radioactivity. Specific areas of known or suspected radioactivity were examined and samples collected and submitted for radiometric and chemical analysis when intensity of radioactivity warranted. Particular emphasis was placed on exploration in the Pre-Cambrian crystalline rocks of the Piedmont and Blue Ridge provinces of Virginia, North Carolina, and eastern Tennessee, the arenaceous formations of early Cambrian age along the western front of the Blue Ridge in Tennessee and Virginia, and the arenaceous formations of late Devonian, early Mississippian and early Pennsylvanian age in Virginia and northwestern Georgia. The degree of anomalous radioactivity ranged from 0.05 mr/hr or only twice background to over 20 mr/hr on veins of uraninite. Radioactivity worthy of note, because of uniformity of distribution, was found in the basal Pennsylvanian sandstones of southwestern Virginia, in the basal Mississippian sandstones of central and southwestern Virginia, in the upper Devonian sandstones of western Virginia, and in the lower Cambrian Rome formation extending from central Virginia to central Alabama. Radioactivity of significance because of concentration was found in the Cranberry granite of Pre-Cambrian age in Avery and Burke counties, North Carolina. Chemical analyses of selected samples from this area have shown the presence of as much as 0.5% U_3O_8. Veins of uraninite have been located in this area. Reconnaissance indicates a relationship between faulting or shearing and concentration of radioactive mineralization. Recommendations are made for further field work in propitious areas, and for petrographic and chemical studies of rocks showing weak but uniformly distributed radioactivity. (auth)

2065 TEI-468

Geological Survey.
RADIOACTIVITY OF COALS AND ASSOCIATED ROCKS IN BEAVER, CLEARFIELD, AND JEFFERSON COUNTIES, PENNSYLVANIA. John C. Ferm. Jan. 1955. 52p.

Radioactivity of coal beds and associated rocks of the Pottsville, Allegheny, and Conemaugh formations was investigated in Beaver, Clearfield, and Jefferson counties, Pa., during the spring and summer of 1953. Measurements of radiation were obtained in the field with a portable scintillation counter, and 165 samples were checked in the office with calibrated counting equipment. Of 56 localities visited, six have beds with radioactivity which is significantly greater than rocks in other localities. Samples from three localities in Beaver County (NC-SW-2-D and E, and NC-SW-3 on table 4 and figure 3) have maximum equivalent uranium of 0.007, 0.014, and 0.005%, respectively; percent U in these samples is 0.007, 0.016, and 0.004. In three localities in Clearfield and Jefferson counties the maximum equivalent U values for coal are in the range of 0.003 and 0.004 and the U content is 0.002%. In the stratigraphic interval studied, rocks associated with the Lower Freeport coal and, to a lesser degree, those associated with the Mercer coals at some places exhibit greater radioactivity than other parts of the stratigraphic sequence. Of the rock types, underclays generally show the greatest amount of radioactivity and coals the least. Analysis of the data indicates that, except on a small scale, the occurrence of more radioactive beds is not related to structure. The data also suggest that moderate surficial weathering in this area has little effect on occurrence of radioactivity. (auth)

2066 TEI-507
Geological Survey.
CONTRIBUTION TO THE CRYSTALLOGRAPHY OF URANIUM MINERALS. Gabrielle Donnay and J. D. H. Donnay Apr. 1955. 42p.

Applying their recently described integrating precession technique, the authors show that most of the existing crystal data on uranyl vanadates, phosphates, and arsenates must be revised. This report gives new cell dimensions (in A, all ±0.3%) and space groups, obtained from rotation, Weissenberg, and precession X-ray photographs; specific gravity determinations made with the Berman balance; and number (Z) of formula units per cell. (auth)

2067 TEI-540
Geological Survey.
GEOLOGIC INVESTIGATIONS OF RADIOACTIVE DEPOSITS. SEMIANNUAL PROGRESS REPORT [FOR] DECEMBER 1, 1954 TO MAY 31, 1955. June 1955. 284p.

Progress on investigations of radioactive materials in the United States and Alaska is reviewed. The principal investigations during the period were in the Colorado Plateau region of Colorado, Utah, Arizona, and New Mexico, and in Wyoming, and the western Dakotas. The drilling program on the Plateau was continued, but no exploration was undertaken elsewhere during the period. Many of the investigations of the USGS have progressed to the point where final reports are in preparation for future publication with the permission of the AEC. Other studies are incomplete and final reports cannot be expected for several years. (auth)

2068
THE NEW DATA ON THE ISOTOPIC CONTENT OF LEAD. A. P. Vinogradov and S. I. Zykov (Vernadskiĭ Inst. of Geochemistry and Analyt. Chem.) Doklady Akad. Nauk S.S.S.R. 105, 126-8(1955) Nov. 1. (In Russian)

The galena deposits where the age of lead, determined by its isotopic content, does not correlate with the age based on geological data, are discussed. The tables of galenite deposits of Pb with the abnormal number of isotopes and the geological age of the deposits are given. (R.V.J.)

METALS AND METALLURGY

2069 AD-36320
Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.
FATIGUE-DILATION STUDY OF 61S-T6 ALUMINUM ALLOY. Report No. 15. B. S. Lement and B. L. Averbach. June 1953. 12p.

It has been reported that a correlation exists between thermal expansion coefficient, endurance limit, and elastic limit in a number of alloys. An investigation was carried out to determine if these findings hold for 61S-T6 aluminum alloy. Dynamic and static tensile tests and the use of a strain gage method for measuring thermal expansion coefficients were investigated. It was found that the thermal expansion coefficient is independent of both dynamic and static stressing in tension at stress levels which span the endurance and elastic limits respectively. The elastic limit was found to be about 50% higher than the endurance limit. (auth)

2070 AECD-3673
Argonne National Lab., Lemont, Ill.
ALLOTROPIC TRANSFORMATIONS IN TITANIUM, ZIRCONIUM, AND URANIUM ALLOYS. A. E. Dwight. Sept. 1953. Decl. with deletions Feb. 2, 1954. 56p. Contract W-31-109-eng-38.

The effect of solute elements on the allotropic transformations in Ti, Zr, and U is shown to vary in a periodic manner with the atomic number of the solute. A thermodynamic quantity serves as the index which controls whether a given solute will raise or lower the transformation temperature. Because it is possible to predict the index quantity for binary systems for which experimental data are lacking, it is possible to predict the effect of untried solute elements on the course of the transformation. Examples are given of practical applications of the calculated index in resolving conflicting data and estimating unknown phase diagrams. (auth)

2071 AECD-3696
Battelle Memorial Inst., Columbus, Ohio.
THE TENSILE STRENGTH OF BRAZED STAINLESS STEEL JOINTS. H. A. Saller, J. T. Stacy, and H. L. Klebanow. July 14, 1953. Decl. with deletions Nov. 17, 1955. 17p. Contract W-7405-eng-92.

The effects of temperature, joint clearance, and annealing on the tensile strength of Type 310 stainless steel T-joints brazed with 62 brazing alloy were investigated. At room temperature, joints with zero clearances were the strongest for all conditions, the strength falling off rapidly up to 0.002-in. clearance. The maximum tensile strength of 90,000 psi was obtained for the as-brazed zero-clearance joint. With increasing clearances, the strength of the joints approached 40,000 psi. Annealed joints varied from 10,000 to 20,000 psi less than as-brazed joints. At elevated temperatures, the tensile strengths were independent of joint clearances. At 1200, 1650, and 1800°F, the average tensile strengths varied from 52, 500 to 57,500, 20,000 to 23,000, and 12,500 to 14,000 psi, respectively, the lower values being those for the annealed specimens. (auth)

2072 BMI-1056
Battelle Memorial Inst., Columbus, Ohio.
COMPOSITIONAL FACTORS AFFECTING CORROSION RESISTANCE OF ZIRCONIUM IN HIGH-TEMPERATURE WATER AND STEAM. Walter K. Boyd, Daniel J. Maykuth, Robert S. Peoples, and Robert I. Jaffee. Nov. 18, 1955. 94p. Contract NObs-65057.

An attempt was made to correlate the composition and structure of a number of sponge Zr alloys with their corrosion resistance in hot water and steam. Increasing the C content of the sponge and crystal-bar melting stocks above their original value of 0.02 wt.% lowered corrosion resistance. Raising the N_2 content at a given C content increased the rate of attack, but not over that normally associated with high N_2 levels. Oxygen, in the range of 0.07 to 0.35 wt.% had no significant effect on the corrosion behavior of either sponge or crystal-bar Zr. Small additions of Ni, Fe, Cr, and Sn improved the corrosion resistance of the base materials, with Fe and Ni being the most effective followed by Cr and Sn. Additions of Ge, Au, Ir, Pd, Pt, and Ru in the range of 0.25 to 4 or 8 wt.% resulted in no significant improvement in corrosion properties of Zr. No correlation of corrosion resistance to structure could be made for the alloys containing O_2, N_2,

and Sn. The detrimental effect of C on the corrosion resistance of the sponge was correlated with the increased amount of the carbide phase. Optimum corrosion resistance in the Ni, Fe, and Cr alloys appears associated with the presence of critical amounts of the intermetallic compounds characteristic of these elements. (auth)

2073 KAPL-1416

Knolls Atomic Power Lab., Schenectady, N. Y.

EFFECTS OF TEMPERATURE AND RADIATION UPON THE TENSILE AND IMPACT PROPERTIES OF ASTM-A302-B MANGANESE–MOLYBDENUM STEEL. E. E. Baldwin Oct. 1, 1955. 60p. Contract W-31-109-eng-52.

With the use of high-yield-strength low-alloy steels for nuclear reactor pressure vessels, it is important to know whether the operating conditions of temperature and radiation will affect the mechanical properties of these steels and the magnitude of such effects Tensile and impact specimens of ASTM-A302-51T Grade B manganese–molybdenum steel were fabricated, canned, charged into the Brookhaven Reactor, and irradiated to an integrated fast neutron flux of 3.7×10^{8} nvt as 500 and 700°F. Comparison of tensile and impact test data on irradiated and unirradiated specimens showed that the separate and combined effects of temperature and radiation had only minor effects (less than 10%) upon the tensile and impact properties of the steel tested. (auth)

2074 LRL-88

California Research and Development Co. Livermore Research Lab., Livermore, Calif.

PRINCIPLES OF VACUUM DISTILLATION OF METAL MIXTURES. J. E. Vivian. Mar. 1954. Decl. Sept. 29, 1955. 30p. Contract AT(11-1)-74.

The principles of vacuum distillation as applied to the separation of mixtures of metals have been critically reviewed. Limitations of the usual simplified equilibrium and rate relations for the batch process are discussed, and relations of more general applications are derived. The concept of relative volatility is used to express the vapor-liquid equilibrium relationships, and the average processing rate is expressed in terms of a rate constant derived from kinetic theory. In practice both the relative volatility and the rate constant required experimental verification. It is expected that the analysis will be of value in preliminary process evaluation and as a guide for correlating experimental data. (auth)

2075 NACA-TN-865

Aluminum Co. of America. Aluminum Research Labs., New Kensington, Penna.

THE DIRECT-STRESS FATIGUE STRENGTH OF 17S-T ALUMINUM ALLOY THROUGHOUT THE RANGE FROM ½ TO 500,000,000 CYCLES OF STRESS. E. C. Hartmann and G. W. Stickley. Apr. 23, 1942. 9p.

Fatigue tests were conducted on six specimens made from ¾-inch-diameter 17S-T Al Alloy rolled-and-drawn rod for the purpose of obtaining additional data on the fatigue life of the material at stresses up to the static strength. The specimens were tested in direct tension using a stress range from zero to a maximum in tension. A static testing machine was used to apply repeated loads in the case of the first three specimens; the other three specimens were tested in a direct tension-compression fatigue machine. The direct-stress fatigue curve obtained for the material indicates that, in the range of stresses, above about two-thirds the tensile strength, the fatigue strength is higher than might be expected by simply extrapolating the ordinary curve of stress plotted against number of cycles determined at lower stresses. (auth)

2076 NACA-TN-3556

Carnegie Inst. of Tech., Pittsburgh.

GRAIN BOUNDARY BEHAVIOR IN CREEP OF ALUMINUM BICRYSTALS. F. N. Rhines, W. E. Bond, and M. A. Kissel. Apr. 15, 1954. 57p.

The gliding of one metal crystal with respect to another parallel to their mutual grain boundary has been studied in pure aluminum bicrystals during isothermal creep at temperatures ranging from 200 to 650°C under static stresses of 10 to 1,600 psi. The motion is spasmodic and begins with an induction period. The mechanism of grain-boundary gliding is described as a coordinated alternation of slip and recovery in a chain of subgrains along the creep boundary. This concept is employed to account both for the rate of primary creep and for the transition from primary to steady-state creep. (auth)

2077 NMI-1119

Nuclear Metals, Inc., Cambridge, Mass.

EFFECT OF TEMPERATURE AND PRESSURE ON STEAM TESTING OF ZIRCONIUM ALLOYS. D. S. Kneppel. Oct. 13, 1954. Decl. Oct. 6, 1955. 48p. Contract AT(30-1)-1565.

For a given temperature in water and steam at 1500 psi, the weight gain at breakaway is a constant independent of the alloy composition in the range studied. Increasing the test temperature increases the weight gain at which breakaway occurs. Alloys containing between 1 and 3 wt.% of iron or chromium show relatively better corrosion resistance with increasing temperature. Alloys containing appreciable quantities of tin should not be tested above 800°F if good reproducibility is to be expected. Testing in 800, 850, and 900°F steam showed poor correlation of steam pressure versus corrosion. Testing at 850°F in 100 psi steam showed no breakaway corrosion. A log-log plot of weight gain versus time for each alloy gave a continuous straight line in all cases. The initial weight gains for the low pressure (100 psi) steam test were lower than those for the higher pressure steam tests. However, with increasing exposure time, the low pressure weight gains approached, and in some cases exceeded, those for the higher pressure steam tests. The 680°F, 2500 psi steam test is a more severe test than 680°F water. Testing in 680°F steam gives weight gains more closely related to those obtained in 750°F steam testing. (auth)

2078 NP-5850

Case Inst. of Tech., Cleveland.

HIGH TEMPERATURE SCALING OF Ni–Cr, Fe–Cr, Cu–Cr AND Cu–Mn ALLOYS. Third and Final Technical Report [for] March, 1955 to November, 1955 [on] THERMODYNAMICS AND KINETICS OF METALS AND ALLOYS. C. A. Barrett, E. B. Evans, and W. M. Baldwin, Jr. Dec. 1955. 64p. DA Proj. No. 5B99-01-004. Contract DA 33-019-ORD-1077.

The high temperature scaling behavior in air of Ni–Cr, Fe–Cr, Cu–Cr and Cu–Mn alloys was studied. Scaling rates and scale compositions were determined as a function of alloy composition. Chromium additions exceeding about 10 percent effected a tremendous decrease in the scaling rate of nickel and of iron. The best scaling resistance of both the Ni–Cr and Fe–Cr alloys was associated with about 20-25 percent chromium and was characterized by a

scale consisting essentially of Cr_2O_3, not the spinel oxide. These findings paralleled those previously obtained with Co–Cr alloys. The scaling rate at this critical concentration was independent of the base metal–be it nickel, iron or chromium. Chromium additions of up to 40 percent to copper had virtually no effect on the scaling resistance. The scale formed on these alloys consisted essentially of copper oxide(s). Cu–Mn alloys exhibited a U-shaped curve relating scaling rate and alloy composition. The best scaling resistance was associated with a critical concentration of about 25 percent manganese, corresponding to the minimum concentration of manganese necessary for the exclusive formation (or nearly so) of manganese oxides in the scale. The theoretical considerations put forth by Wagner were utilized as an aid in interpreting the scaling behaviors. (auth)

2079 NP-5851

California. Univ., Berkeley. Minerals Research Lab.
EFFECT OF STRAIN RATE AND TEMPERATURE ON THE PLASTIC DEFORMATION OF HIGH PURITY ALUMINUM. Technical Report No. 44. T. A. Trozera, O. D. Sherby, and J. E. Dorn. Dec. 1, 1955. 21p. Project NR-031-048. Contract N7-onr-295, Task Order II.

The effect of temperature and strain rate on the stress-strain curves of aluminum were obtained over the ranges of temperatures, T, from 78 to 818°K and strain rates, $\dot{\epsilon}$, from 0.0035 to 600 per hour. The stress-strain curves so obtained formed a homologous set illustrating that identical stress-strain curves were obtained for constant values of the Zener-Hollomon parameter $Z = \dot{\epsilon}e^{\Delta H/RT}$ where ΔH is an activation energy and R is the gas constant. For a series of low stress-strain curves ΔH had the constant value of 35,000 cal. per mole. Since this agrees with the activation energy for self-diffusion in aluminum, it is believed that in these cases the mechanism of deformation is controlled by a dislocation climb process. Higher stress-strain curves gave correspondingly lower activation energies. The rather sharp transition from constant values of ΔH to decreasing values of ΔH as the stress-strain curve increases suggests a change in the rate-controlling process for deformation. The lower values of ΔH obtained in this range further suggest that for the higher stress-strain curves more of the energy necessary for deformation is supplied mechanically and therefore the contributions due to thermal fluctuations decrease. (auth)

2080 NP-5858

Battelle Memorial Inst., Columbus, Ohio.
THE EFFECT OF HYDROGEN ON THE MECHANICAL PROPERTIES OF TITANIUM AND TITANIUM ALLOYS AND CONTROL OF HYDROGEN IN TITANIUM AND TITANIUM ALLOYS. Quarterly Progress Report No. 2. G. A. Lenning, L. W. Berger, W. M. Albrecht, M. W. Mallett, D. N. Williams, and R. I. Jaffee. Sept. 15, 1955. 43p. Task No. 30134. Contract AT-53(616)-2813.

Studies of the H embrittlement of Ti alloys suggest that hydrogen induces brittleness by reducing the ability of the α-β boundary region to withstand triaxial stresses. Data are tabulated on the effect of cold work on H embrittlement and the effect of H charging and degassing on the mechanical properties of Ti alloys. The effect of compositional variables on the H embrittlement of α-β type Ti alloys was studied, and resultant data are tabulated, including data on stress-rupture properties, tensile properties, and impact strengths. Diffusion coefficients of H in Ti alloys are given. Data on the low-pressure solubility of H in Ti and Ti alloys are tabulated. A brief discussion is given on the factors affecting pickup of H. (B.J.H.)

2081 NYO-7049

Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.
THE STRUCTURE OF LITHIUM–MAGNESIUM SOLID SOLUTIONS. PART I. MEASUREMENTS ON THE BRAGG REFLECTIONS. Technical Report No. 27. F. H. Herbstein and B. L. Averbach. Sept. 30, 1955. 27p. Contract AT(30-1)-1002, Scope II.

Lattice parameters have been measured at 20°C and –183°C for seven BCC Li–Mg alloys. There is a strong negative deviation from Vegard's Law and a minimum in the parameter-composition curve at 65 at.% Li. Two measurements have been made on martensitic FCC Li–Mg alloys at –183°C, and a negative deviation from Vegard's Law is also indicated for these alloys. In the HCP solid solutions of Li in Mg, both the $\underline{a}$ and $\underline{c}$ axes decrease with increasing Li content, while the $\underline{c}/\underline{a}$ ratio decreases from 1.6235 for pure Mg to 1.608 at 18.4 at.% Li (the $\alpha/\alpha + \beta$ phase boundary). The presence of local static displacements of the atoms from the sites of the average lattice has been demonstrated from measurements of the Bragg intensities at 295 and 90°K. These intensity measurements have also been used to derive values of the Debye characteristic temperature for five BCC alloys. (auth)

2082 NYO-7051

Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.
X-RAY MEASUREMENTS OF ORDER IN THE COBALT–PLATINUM SYSTEM. Technical Report No. 29. P. S. Rudman and B. L. Averbach. Sept. 30, 1955. 18p. Contract AT-(30-1)-1002, Scope II.

The long-range order in the alloy Co–Pt has been measured by means of x-ray intensity and lattice tetragonality measurements on powder briquettes quenched from various annealing temperatures. The long-range order vanishes discontinuously from a value of $S_c = .78$ on heating above the critical temperature, $T_c = 833 \pm 2$°C. Local order and size effect coefficients were also obtained for a series of Co–Pt alloys by means of diffuse scattering measurements from powder briquettes quenched from the disordered phase. Short range order coefficients (i.e. a preference for unlike neighbors) of the same magnitude as those found in the Au–Cu system and size effect coefficients similar to those found in the Au–Ni system were observed. (auth)

2083 WADC-TR-55-205

Climax Molybdenum Co. of Michigan, Detroit.
OXIDATION-RESISTANT COATINGS FOR MOLYBDENUM. J. R. Blanchard. June 1955. 42p. Project Title: METALLURGY AND METALLIC MATERIALS. Task Title: CORROSION AND HEAT RESISTING ALLOYS. Contract AF(616)-2488.

Sprayed-metal coatings, electrodeposited coatings and molten metal dipped coatings for the protection of molybdenum against oxidation at 1800° and 2000°F, under several simulated service conditions were investigated. The investigation included a study of the influence of grit blasting technique, preparation of corners and edges, the amount

of oxidation of the molybdenum surface, and thickness of specimen on the reproducibility of oxidation test results, using the single layer aluminum–chromium–silicon coating applied with commercial metallizing equipment. Changes in the nature of the aluminum–chromium–silicon coating as a result of diffusion treatment and varying exposures to oxidation at 1800°F were studied, using metallographic and x-ray-diffraction techniques. Changes in weight were also studied. A ballistic impact test was constructed for evaluating the resistance of coatings to spalling at elevated temperatures; several sprayed-metal coatings were tested at 1800°F. Oxidation tests at 1800 and 2000°F and/or tests under conditions of rapid thermal cycling between room temperature and 1800°F were conducted, using panels of coated unalloyed molybdenum. (auth)

2084 WAPD-129

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

THE ULTRASONIC INSPECTION OF CAST AND WROUGHT URANIUM-12 W/O MOLYBDENUM ALLOY. W. B. Haynes and E. A. Proudfoot. Nov. 30, 1955. 27p. Contract AT-11-1-gen-14.

Ultrasonic inspection of U–12 wt.% Mo fuel components has been investigated and found to be practicable for determining heterogeneities in the material. Defects on the order of $\frac{3}{16}$-in. diam. can be detected. Heterogeneous structures can be determined by the shape of the back reflections. Relative grain size can be determined by the difference in the number of back reflections. (auth)

2085 AEC-tr-2365

THE KINETICS OF OXIDATION OF NICKEL AT 400°C. H. -J. Engell, K. Hauffe, and B. Ilschner. 8p. Translated from Z. Elektrochem., 54, 478-82(1954). Available from Associated Technical Services (Trans. 95G7G), East Orange, N. J.

The kinetics of formation of oxide layers on Ni at 400°C and oxygen pressures between 30 and 240 mm Hg were investigated by volumetric determination of the O_2 uptake by foil samples with use of a differential tensiometer. It was found that up to about 1000 A the layer thickness increases proportionately with the 3.7th root of the time and at greater layer thicknesses increases further according to the "parabolic" scaling rate law. The qualitative agreement with the results of other authors is good. The approximate "cubic" rate law is ascribed to the considerable influence of space charge-surface layers in thin oxide films. A simplified calculation with consideration of the electrostatic space charges and fields as well as the concentration gradients of Ni ion vacancies, with plausible hypotheses, in fact yields a cubic rate law. (auth)

2086 AEC-tr-2366

ON THE MECHANISM OF THE OXIDATION OF Cu_2O AT HIGH TEMPERATURES. Karl Hauffe and Per Kofstad. Translated from Z. Elektrochem., 39, No. 5, 399-404(1955). 8p. Available from Associated Technical Services (Trans. 96G7G), East Orange, N. J.

Oxidation of Cu_2O samples at various pressures of O showed a cubic rate law at temperatures between 800 and 1000°C. Also the temperature dependence of the rate of oxidation is extraordinarily small in this range of temperatures. The observed dependence of the rate of oxidation of Cu_2O to CuO on the oxygen pressure during the oxidation and on the oxygen pressure during pretreatment of the Cu_2O before oxidation can be interpreted with the aid of the boundary layer theory. (auth)

2087

THE LATTICE SPACINGS OF SOLID SOLUTIONS OF TITANIUM, VANADIUM, CHROMIUM, MANGANESE, COBALT AND NICKEL IN α-IRON. A. L. Sutton and W. Hume-Rothery (Inorganic Chemistry Lab., Oxford, England). Phil. Mag. (7) 46, 1295-1309(1955) Dec.

Accurate measurements have been made of the lattice spacings of dilute solid solutions of Ti, V, Cr, Mn, Co and Ni in α iron. In all cases the formation of the solid solution results in an expansion of the Fe lattice, and for equal atomic percentages of the solutes, the expansions are in the order Ti > V > Cr and Co < Ni < Cu. Mn behaves anomalously, its effect being nearly the same as that of Cr. With Ti and V as solutes there are negative deviations from Vegard's law, while for the remaining solutes the deviations are positive. These results, together with previous work on Ni alloys, are discussed, and some of the effects are ascribed to exchange repulsion between nearly filled d shells. (auth)

2088

ON ZERO CHARGE POTENTIALS IN COPPER AND CHROMIUM. E. A. Uske and A. I. Levin (Urals S. M. Kirov Polytech. Inst.). Doklady Akad. Nauk S.S.S.R. 105, 119-22 (1955) Nov. 1. (In Russian)

The zero charge potentials in various metals and their dependence on the solution content are not yet sufficiently investigated. Special measurements of zero points in various media are of interest. Some preliminary results of measurements of zero potentials in copper and chromium are given. The method correlating the angles formed by boundaries of the bubbles lying on the surface of the metallic solution and the potential of the electrode is used in the investigation. (R.V.J.)

2089

THERMAL DIFFUSION IN LIQUID METALS. F. R. Winter and H. G. Drickamer (Univ. of Illinois, Urbana). J. Phys. Chem. 59, 1229-30(1955) Dec.

Thermal diffusion measurements have been made on a series of liquid metal mixtures. The results are totally consistent with a previously presented theory. The separations depend on the "activation energy density" $\Delta U \div /V$ of the components. It is also shown that the quantity $X(\partial\mu/\partial X)$ in the denominator is important for quantitative prediction of the separation. Results also are presented and discussed for three ternary mixtures. (auth)

2090

TEMPERATURE DEPENDENCE OF HARDNESS OF THE EQUI-ATOMIC IRON GROUP ALUMINIDES. J. H. Westbrook (General Electric Co., Schenectady, N. Y.). J. Electrochem. Soc. 103, 54-63(1956) Jan.

A series of iron group aluminides, a typical group of intermetallic compounds, were prepared by arc melting and their hardness studied as a function of temperature and composition using a modified Bergh instrument. FeAl-, CoAl-, and NiAl-based materials were studied up to 800°C and over the entire homogeneity range of each compound. The results appear to be related to the defect structure in such materials. (auth)

Refer also to abstracts 2060, 2091, and 2227.

PHYSICS

2091 HW-38982

Hanford Atomic Products Operation, Richland, Wash.

THE DIFFUSION OF URANIUM INTO ALUMINUM. T. K. Bierlein and D. R. Green. Oct. 6, 1955. 23p. Contract W-31-109-Eng-52.

The maximum penetration of uranium into aluminum in the temperature range 200 to 390°C (392 to 734°F) has been investigated. The maximum values for the penetration coefficient K_T, determined from the realtionship $K_T = x^2/t$, are 0.075, 0.50, and 6.1×10^{-6} inches^2/hour at temperatures of 200, 250, and 390°C (392, 482, and 734°F), respectively; the corresponding activation energy is 14,300 calories per mole. The utility of cathodically vacuum etching specimens to obtain clean metal surfaces prior to the diffusion anneal is demonstrated. Couples prepared in the temperature range investigated, 200 to 390°C (392 to 734°F), fracture by the application of tension between the aluminum and the adjacent UAl_3 diffusion zone interface. Subsequent measurement of the maximum UAl_3 peak heights above the initial uranium-aluminum interface assures a maximum value of penetration coefficient. The investigation provides a necessary basis for interpreting the effect of irradiation on the diffusion rates of uranium into aluminum. (auth)

2092 KAPL-828

Knolls Atomic Power Lab., Schenectady, N. Y.

THEORY AND APPLICATION OF SLIDING CONTACT OF METALS IN SODIUM. L. F. Coffin, Jr. (Paper Presented at Liquid Metals Information Meeting October 9, 1952). Decl. Oct. 6, 1955. 39p. Contract W-31-109-Eng-52.

Metallic friction, wear, and surface damage during metallic sliding are generally believed to be due to the welding of surface asperities and the immediate breaking of these welds. This report considers in greater detail the nature of these welds. It is concluded that wear and surface damage are principally dependent on the alloying tendency between the metals in the couple. A sliding couple, having considerable mutual solubility of forming an intermetallic compound, should undergo serious surface damage. In the case of a very low solubility couple which forms no intermetallic compound, the surface damage is slight. A study of the surface damage to many different couples, which results when a rotating disk of one metal is rubbed against a fixed rider of a second metal in air, under severe loads, for some 100 revolutions, conclusively proves this hypothesis. Thrust-bearing tests have been performed in sodium for two couples selected by the solubility hypothesis. These couples exhibit the property of extreme wear-in, so that, following high coefficients of friction upon initial load applications, hydrodynamic operation of the bearing ensues. This has been found true for bearing pressures up to 200 psi at temperatures up to 400°C. Marked temperature sensitivity of these bearings has been noted and is due to the extremely thin film of sodium between the bearing faces. (auth)

2093 NP-4859(Suppl.7)

Little (Arthur D.) Inc., Cambridge, Mass.

LOW TEMPERATURE BIBLIOGRAPHY FOR THE FIELD OF CRYOGENICS. SUPPLEMENT NO. 7. Nov. 1955. 9p.

This compilation consists of reports issued after 1944 on low-temperature physics, including theoretical and experimental research at temperatures of 20°K and below, together with techniques and equipment applicable to this region. (auth)

2094

THEORETICAL ELECTROMOTIVE FORCES FOR CELLS CONTAINING A SINGLE SOLID OR MOLTEN CHLORIDE ELECTROLYTE. Walter J. Hamer, Marjorie S. Malmberg, and Bernard Rubin (National Bureau of Standards, Washington, D. C.). J. Electrochem. Soc. 103, 8-16(1956) Jan.

From thermodynamic data, electromotive forces have been calculated for reversible galvanic cells of the type $M/MCl_n/Cl_2(z)$ where M is a metallic element in the solid, liquid, or gaseous state and MCl_n is the corresponding chloride in the solid or liquid state. Results are given for temperatures from 25 to 1500°C. The chlorides are listed in a series and compared with the electromotive force series of the elements in aqueous solutions. Comparisons are given with results obtained from galvanic cells with fused chlorides or from measurements of decomposition voltages. (auth)

COSMIC RADIATION

2095

INTERPLANETARY MAGNETIC FIELDS AND COSMIC RAYS. Leverett Davis, Jr. (California Inst. of Tech., Pasadena). Phys. Rev. 100, 1440-4(1955) Dec. 1.

The existence in the region around the sun of a field-free cavity in the galactic magnetic field seems indicated by the low-energy cosmic rays that reach the earth from the sun. Such a cavity would be produced by the solar corpuscular emission. A mean radius of the order of 200 times the distance from the sun to the earth may be estimated for this cavity by balancing the flux of momentum against the lateral pressure exerted by a field of 10^{-5} gauss. Such a cavity would trap cosmic rays of energy less than 100 Bev for periods long compared to a sunspot cycle, but does not seem to make possible a solar origin of cosmic rays. Expected fluctuation in cavity size would explain the 4% fluctuation in cosmic-ray intensity observed by Forbush. A simple model of the cavity is considered in some detail, rates of escape from and entry to the cavity, acceleration by the Fermi mechanism, and change in energy density being estimated. More complicated models involving a solar magnetic field are considered briefly. (auth)

2096

ASSOCIATED PRODUCTION OF Ξ WITH TWO θ^0 PARTICLES. J. D. Sorrels, R. B. Leighton, and C. D. Anderson (California Inst. of Technology, Pasadena). Phys. Rev. 100, 1457-9(1955) Dec. 1.

A cosmic-ray event is described in which a negative cascade particle and two neutral heavy mesons appear to be produced in a single nuclear interaction above a cloud chamber. It is suggested that this event may be an example of the associated production of a Ξ^- particle with two θ^0 particles according to the scheme of Gell-Mann. (auth)

2097

DETERMINATION OF THE INTENSITIES OF LOW-Z COMPONENTS OF THE PRIMARY COSMIC RADIATION AT $\lambda = 41°$ USING A ČERENKOV DETECTOR. William R. Webber and Frank B. McDonald (State Univ. of Iowa, Iowa City). Phys. Rev. 100, 1460-7(1955) Dec. 1.

A measurement of the intensities of the low-Z components of the primary cosmic radiation has been made in the upper atmosphere at a depth of 13 g/cm^2 by means of a "Skyhook" balloon flown at $\lambda = 41.5°$. The measuring instrument consisted of a thin (3.0 g/cm^2) Cherenkov detector placed within the solid angle of a Geiger counter telescope. A Cherenkov detector was used because of its unique discrimination against slow particles. A system of guard and shower counters and circuits was included to identify side showers and background events occurring in the detector. A vertical intensity of 82 ± 9 α particles/meter^2 steradian sec, at the top of the atmosphere was obtained, based on 374 counts attributed to α particles. Data obtained as the balloon rose to altitude gave a value of 43 ± 8 g/cm^2 for the apparent absorption mean free path of α particles in air. An upper limit was set on the intensity of primary protons at this depth. In addition, a small number of counts that could be attributed to particles with $3 \leq Z \leq 5$ were obtained and are discussed. (auth)

2098

CLOUD-CHAMBER INVESTIGATION OF CHARGED V PARTICLES. G. H. Trilling and R. B. Leighton (California Inst. of Tech., Pasadena). Phys. Rev. 100, 1468-75(1955) Dec. 1.

An analysis of 84 charged V events obtained during two years of operation of a vertical magnetic cloud-chamber array is presented. The particular features of interest which are studied in detail are the distribution of P*, the momentum of the charged secondary in the rest system of the primary, and the possible existence of a component of short lifetime (i.e., $\tau < 5 \times 10^{-10}$ sec). The P* distribution from 19 slow, accurately measurable positive events is shown to imply that the large majority of these events arise from one or more two-body decays from primaries of mass approximately equal to that of the τ meson. One case turns out to be inconsistent with this interpretation, and is presumed to represent a three-body decay. The P* distribution from 6 slow, accurately measurable negative events is consistent with a single two-body decay having a P* value of about 200 Mev/c. This suggests the existence of a negative counterpart to the well-known θ^0 particle, though the statistics are much too poor to permit any strong conclusion. The lifetime analysis provides strong evidence for the existence of a negative component of lifetime equal to or less than $(1.3 \pm 0.6) \times 10^{-10}$ sec. The transverse momentum distribution for these short-lived events is shown to suggest a two-body decay with a P* value of 201 ± 12 Mev/c. (auth)

2099

NONMESONIC DECAY OF A HELIUM HYPERFRAGMENT. Nathan Seeman, Maurice M. Shapiro, and Betram Stiller (Naval Research Lab., Washington, D. C.). Phys. Rev. 100, 1480-4(1955) Dec. 1.

In an emulsion stack exposed in an equatorial balloon flight, an event was observed which is most simply interpreted as the disintegration of a He^{4*} hyperfragment according to the scheme $He^{4*} \rightarrow p + d + n + Q$, where Q = 167.6 ± 2.9 Mev. The fragment, emerging from a star of type 11 + 7α, traveled 633 μ before coming to rest. All the measurements, including those on the fragment track, are consistent with the foregoing decay scheme. Other interpretations are considered and shown to be untenable or very unlikely. From the Q-value and the relevant masses, the binding energy of the Λ^0 in the fragment is 1.9 ± 2.9 Mev, in agreement with values from mesonic disintegrations of He^{4*}. This low binding energy may be compared to the much larger value, 20.6 Mev, with which the "last neutron" is bound in normal He^4. (auth)

2100

Λ^0-FRAGMENT DECAY IN A CLOUD CHAMBER. J. D. Sorrels, G. H. Trilling, and R. B. Leighton (California Inst. of Tech., Pasadena). Phys. Rev. 100, 1484-6(1955) Dec. 1.

The decay in flight of a heavy neuclear fragment is described. The event is most reasonably interpreted as the decay of a Λ^0 particle bound to a He^3 nucleus, and is similar to examples previously observed in nuclear emulsions. The lifetime of the excited fragment in this single example is $5.4 \pm 0.6 \times 10^{-10}$ sec, and the binding energy of the Λ^0 to He^3 is probably less than 2 Mev. (auth)

2101

HEAVY UNSTABLE PARTICLES; (HYPERONS AND K-MESONS). A. O. Vaisenberg. Uspekhi Fiz. Nauk 57, 361-434(1955) Nov. (In Russian)

History and review of the up-to-date experimental methods of investigation of heavy unstable particles and the methods of analysis of the data as well as diagrams and tables are given. The data on heavy unstable particles from the proceedings of the Bagnier (June 1953) and Padua (April 1954) Conferences and the detailed chart on particle decay are given. Additional data describing the experiments and work performed up to April, 1955 are included. 118 references. (R.V.J.)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

Refer to abstracts 2081 and 2087.

ELECTRONS

2102

IONIZATION IN A MASS SPECTROMETER BY MONOENERGETIC ELECTRONS. R. E. Fox, W. M. Hickam, D. J. Grove, and T. Kjeldaas, Jr. (Westinghouse Research Labs., East Pittsburgh). Rev. Sci. Instr. 26, 1101-7(1955) Dec.

Over the last few years, a method has been developed for obtaining ionization probability curves with essentially monoenergetic electrons. A retarding potential is applied to the electron beam to yield an energy distribution with a sharp low-energy limit. By varying the retarding potential slightly, a new low-energy limit of the distribution can be selected. The difference in the ionization produced in the two cases is ionization by those electrons with a small energy spread selected from the original distribution. By pulsing the electrons and ions, it is possible to eliminate the adverse effect of the ion-drawout field on the electron energy. With this retarding potential difference (RPD) method, a detailed analysis of ionization probability curves is possible. A full description of this method is given in this paper with a discussion of its advantages and limitations. The mass spectrometer used in this series of studies is described, particular attention being given to a description of the ion source. The various electrodes of the electron beam slit system are described in terms of their influence on the electron energy, and on the shapes of ionization probability curves. (auth)

INSTRUMENTS

2103 UCRL-3215

California. Univ., Berkeley. Radiation Lab.

ELECTRON MULTIPLIER FABRICATION. Frederick L. Reynolds. Dec. 1955. 18p. Contract W-7405-eng-48.

Fabrication and assembly details are given for the construction of a sixteen-stage silver–magnesium dynode electron multiplier. The unit has been used primarily for positive-ion detection in mass spectroscopy. (auth)

2104

FOCUSING ATOMIC BEAM APPARATUS. Aaron Lemonick, Francis M. Pipkin, and Donald R. Hamilton (Princeton Univ., N. J.). Rev. Sci. Instr. 26, 1112-19(1955) Dec.

The construction and design principles of an atomic beam focusing apparatus are reported. This apparatus, which is of the radio-frequency magnetic resonance type and which has been used to measure the spins and hyperfine splittings of four radioactive nuclides as reported elsewhere, utilizes the six-pole focusing magnet of Friedburg and Paul and of Korsunskii and Fogel but in a way which avoids velocity aberrations. From an analysis of the optimization of intensities in the conventional and the focusing types of atomic beam apparatus it is concluded that the latter has an advantage of a factor of roughly twenty-five. (auth)

Refer also to abstract 2048.

ISOTOPES

2105 KT-183

Massachusetts Inst. of Tech., Oak Ridge, Tenn. Engineering Practice School.

P^{32} PRODUCTION IN THE X-REACTOR. A. D. Rossin, C. J. Billerbeck, W. S. Delicate, and A. W. Wendling. Oct. 27, 1954. 28p. [For] Carbide and Carbon Chemicals Co. [K-25 Plant. Contract W-7405-eng-26, Subcontract 70].

A method is presented for calculating the rate of production of P^{32} in the X-10 Graphite Reactor in order to determine the most efficient schedule for the irradiation of cans of sulfur in the reactor. Variables in the process are the number of cans inserted each week and the length of time and level of irradiation of each can. Limitations are imposed by the demand for P^{32}, the high cost of chemical processing, availability of reactor space, and the operating schedule for the reactor. The distribution of neutron flux responsible for the reaction is determined by the irradiation of aluminum sulfate and details of the method are discussed. The results of the study indicate that no other production schedule offers a sufficient increase in efficiency over the schedule now used to justify a change. (auth)

Refer also to abstracts 2068 and 2210.

MASS SPECTROGRAPHY

2106

TIME-OF-FLIGHT MASS SPECTROMETER WITH IMPROVED RESOLUTION. W. C. Wiley and I. H. McLaren (Bendix Aviation Corp. Research Labs., Detroit). Rev. Sci. Instr. 26, 1150-7(1955) Dec.

A new type of ion gun is described which greatly improves the resolution of a nonmagnetic time-of-flight mass spectrometer. The focusing action of this gun is discussed and analyzed mathematically. The validity of the analysis and the practicability of the gun are demonstrated by the spectra obtained. The spectrometer is capable of measuring the relative abundance of adjacent masses well beyond 100 amu. (auth)

2107

MASS SPECTRA OF CuCl, CuBr, AND CuI. H. M. Rosenstock, J. R. Sites, J. R. Walton, and Russell Baldock (Oak Ridge National Lab., Tenn.). J. Chem. Phys. 23, 2442(1955) Dec.

Mass spectral studies of CuCl, CuBr, and CuI indicate that the predominant vapor species is the trimer. Tetrameric ions were also found. (C.W.H.)

MATHEMATICS

2108 IDO-16173

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

AN ANALYSIS OF THE ACCURACY OF PERTURBATION THEORY. J. W. Webster. June 17, 1954. Decl. Sept. 28, 1955. 24p. Contract AT(10-1)-205.

This report discusses the accuracy of two-group perturbation theory as a method of calculating the effect on reactivity of small changes to the composition of a reactor. The evaluation is based on a comparison of reactivity changes calculated by group theory and perturbation theory for cases involving uniform changes in the core or reflector. The group theory has fewer approximations to apply than perturbation theory. It can only be used for uniform changes whereas the latter can be used for localized and non-uniform changes. Equivalent methods of expressing reactivity changes are first derived. Perturbation theory is compared with standard two group theory for uniform changes in composition of a proposed MTR Reactivity Measurement Facility. It is concluded that perturbation theory is accurate within one part in ten for a uniform change in any one constant of 15% or less. Graphs are given of reactivity effect versus arbitrary percentage change in the various constants as calculated by the two methods. The generalized formula of perturbation theory is discussed term by term and a physical interpretation is shown to exist for each term. (auth)

2109 NP-5844

Redstone Arsenal. Ordnance Missile Labs., Huntsville, Ala.

SAMPLING STUDIES OF RELIABILITY. Special Report No. 2. Irwin Miller. Feb. 1, 1954. 8p. (RSA/OML Spec. Rpt. 2).

The logical and statistical framework is presented for tests to ensure the maintenance of reliability of guided missile systems. Criteria are presented for sample selection. Samples are diverted from production solely for test purposes and test are conducted under simulated combat conditions insofar as possible. Graphical and tabular results and instructions for use are appended. (C.H.)

2110

ON THE ASYMPTOTIC APPEARANCE OF GREEN'S

ELECTRON FUNCTION. L. P. Gor'kov (Vavilov Inst. of Physical Problems). Doklady Akad. Nauk S.S.S.R. 105, 65-8(1955) Nov. 1. (In Russian)

Using the Gell-Mann and Low method (Phys. Rev. 95, 1300(1954)), some corrections are introduced in Green's electron function for the e^4 order of the excitation theory. (R.V.J.)

2111

STATISTICAL MECHANICS OF ISOTOPIC SYSTEMS WITH SMALL QUANTUM CORRECTIONS. I. GENERAL CONSIDERATIONS AND THE RULE OF THE GEOMETRIC MEAN. Jacob Bigeleisen (Brookhaven National Lab., Upton., N. Y.). J. Chem. Phys. 23, 2264-7(1955) Dec.

It is shown that the differences in the thermodynamic properties of isotopic molecules subject to small quantum effects ($u^2/24$ law) depend on the difference in the reciprocal masses of the atoms in the molecule and are, therefore, independent of all masses except of those atoms isotopically substituted. This theorem provides a rigorous proof of the rule of the geometric mean of gaseous molecules. It is shown that the partition function ratio for a pair of double-labeled molecules, e.g., $N^{15}D_3/N^{15}H_3$ is equal to the ratio for the single-labeled pair $N^{14}D_3/N^{14}H_3$. The application of the $u^2/24$ law to isotopic isomer equilibria is pointed out. (auth)

MEASURING INSTRUMENTS AND TECHNIQUES

2112 MLM-572

Mound Lab., Miamisburg, Ohio.

OPERATORS' MANUAL FOR PRECISION ALPHA COUNTING. M. L. Curtis. Nov. 4, 1952. Changed from OFFICIAL USE ONLY Sept. 2, 1955. 41p. Contract AT-33-1-GEN-53.

This manual on α counting was prepared for the use of semi-technical personnel having limited scientific backgrounds. The presentation is simple and concise. Factors affecting α counting are discussed, specific operating instructions are presented for the more common types of counters, and methods are described for calibration of instruments, reporting results, and methods of decontamination. (C.H.)

2113

CAVITY ION CHAMBER THEORY. P. R. J. Burch (Univ. of Leeds, England). Radiation Research 3, 361-78(1955) Dec.

A method is presented of cavity ionization chamber dosimetry of x and γ radiation, which takes into account the discontinuous energy losses by electrons in the form of δ-tracks. Calculations are included for the irradiation of an air-filled graphite chamber by Co^{60} γ-rays and for the same chamber by Na^{24} γ-rays. (C.H.)

2114

THE EFFECTS OF THALLIUM CONCENTRATION ON THE GAMMA AND PHOTOLUMINESCENCE EMISSION OF NaI-Tl CRYSTALS. L. M. Belyaev, M. D. Galanin, Z. L. Morgenshtern and Z. A. Chizhikova. (Lebedev Inst. of Phys.) Doklady Akad. Nauk S.S.S.R. 105, 57-60 (1955) Nov. 1. (In Russian)

The effects of activator concentration on the luminescence emission of NaI-Tl crystals with Co^{60} γ rays and photoexcitation is investigated and the comparison with KI-Tl crystal series previously similarly investigated are given. (R.V.J.)

2115

GEIGER COUNTING OF CARBON DIOXIDE. E. Broda (Universitat Vien, Osterreich). J. Inorg. and Nuclear Chem. 1, 411-12(1955) Dec.

A Geiger counter, employing an external quenching circuit (Neher-Pickering), has been adapted for radiocarbon determinations. The sensitivity of the method is comparable with other routine assay methods. (C.W.H.)

2116

MEASUREMENT OF FIELD DISTORTION IN FREE-AIR IONIZATION CHAMBERS BY ANALOG METHOD. William Miller and Robert J. Kennedy. J. Research Natl. Bur. Standards 55, 291-7(1955) Nov.

A two dimensional analog of a free-air ionization chamber for the measurement of field distortion was obtained by painting conducting lines on resistance paper to represent cross sections of the electrodes. Guard wires were simulated by driving record player needles into the paper. The volume of the chamber from which charge was collected was related to the resistance between two of the lines on the paper, and small changes in this volume could be determined accurately by observing resistance changes. Grounded plates external to the chamber were simulated by additional lines painted on the paper, and the effect of these plates on the collecting volume was determined by measuring a change in resistance as the potential of these (simulated) external plates was changed. Measurements were also made for guards in the form of double wires and strips. (auth)

2117

MAGNETIC ANALYSIS OF SCATTERED PARTICLES. H. P. Furth (Harvard Univ., Cambridge, Mass.). Rev. Sci. Instr. 26, 1097-1100(1955) Dec.

The theory of conditioned probabilities is applied to the problem of momentum, charge, and mass determination from Coulomb scattered tracks in a magnetic field. An optimum procedure is derived, which makes use of both random and systematic track curvature. It is shown that application of this procedure to a highly relativistic nuclear emulsion track of 1-cm length in a field of 300,000 gauss will yield the momentum information of a 9.2-cm track in zero field. If the scattering information were neglected, the effective length of the track would be 8.2 cm. At 100,000 gauss, the improvement in effective track length due to the inclusion of scattering information is shown to be by a factor of 2.3. (auth)

2118

IMPROVED ALPHA AIR PROPORTIONAL COUNTER. Frank J. Lynch and James B. Baumgardner (Argonne National Lab., Lemont, Ill.). Rev. Sci. Instr. 26, 1134-7(1955) Dec.

The limitations of alpha counters using air in the proportional amplification region were investigated with a view toward a better design that would provide improved performance and reliability. A new detector is described which incorporates a shielded guard-ring insulator assembly that provides freedom from insulator failure at high humidities. It is believed that spurious pulses also arise from the effect of humidity on the conductivity of foreign particles adhering to the anode wires. Reducing the relative humidity (rh) by the use of a small heater which

maintains the detector 20°F above room temperature prevents this type of failure and provides reliable operation at 98% rh. The associated amplifier and discriminator were designed to detect the slow components of the ionization pulses associated with the transit time of negative oxygen ions. The resulting efficiency is 39% of the total disintegrations, with a plateau of over 150 volts having a slope of less than 4% per 100 volts. (auth)

2119

FAST NEUTRON COINCIDENCE SPECTROMETER. II. Paul R. Chagnon, George E. Owen, and Leon Madansky (Johns Hopkins Univ., Baltimore). Rev. Sci. Instr. 26, 1165-70(1955) Dec.

A fast neutron coincidence spectrometer utilizing stilbene scintillators is described. The principle of the spectrometer is based upon the pulse-height analysis of the recoil protons resulting from a 45 degree scattering of the incident neutron beam. This is achieved by requiring the scattered neutron to be recorded in a secondary ring of ten stilbene scintillators. With delays corresponding to a fixed time of flight, a coincidence between the primary and secondary crystals gates the primary pulse. At 4 Mev, the efficiency is of the order of 10^{-4} per incident neutron, and the pulse-height distribution has a width at half-maximum of 17%. The corresponding energy width is 10%. The time-of-flight characteristic is used to reject gamma rays. Limitations caused by accidentals and pulse-height resolution are discussed. (auth)

2120

LARGE SCINTILLATORS AS THRESHOLD DETECTORS FOR HIGH-ENERGY PROCESSES. J. J. Thresher, C. P. van Zyl, R. G. P. Voss, and R. Wilson (Clarendon Lab., Oxford, England). Rev. Sci. Instr. 26, 1186-91(1955) Dec.

The design is described of several liquid organic scintillation counters which have been used to detect 100-Mev neutrons and gamma rays with the exclusion of lower-energy particles and quanta. The neutron counter efficiency is a few percent and is nondirectional, properties not possessed by a more conventional counter telescope system. The gamma-ray counter has an efficiency of about 50%, with a line width of about 10%. Particular problems arise in the use of these counters; counting rate stability is difficult to achieve; the maximum counting rate is limited by the pileup of individual pulses due to their finite width. These problems are discussed in detail and some solutions mentioned. (auth)

2121

MILLIMICROSECOND TIMING WITH LARGE SCINTILLATION DETECTORS. J. W. Knoefel, W. H. Sandmann, and R. K. Stitt (Univ. of Utah, Salt Lake City). Rev. Sci. Instr. 26, 1191-5(1955) Dec.

The timing precision attainable with large liquid scintillation detectors has been studied. Such detectors have slow rise-times (~10^{-8} sec) compared with those used in conventional nuclear physics timing experiments. The rise-time is a result of photon time of flight and transit time in the larger, slower photomultipliers (such as the Dumont 6364) which must be used for good light collection. However, timing errors due to rise-time may be largely overcome when dealing with large, statistically smooth pulses such as are encountered in cosmic-ray experiments with unstable particles. A simple correction based on the pulse height is applied to each time measurement. Using this technique a timing error curve is obtained with a standard deviation of 1.6 mμsec for a large detector using a Dumont 6364. (auth)

2122

IMPROVING PROPORTIONAL COUNTER RESOLUTION WITH A GRAPHITE CATHODE LINER. S. D. Bloom, E. G. Reilly, and B. J. Toppel (Brookhaven National Lab., Upton, N. Y.). Rev. Sci. Instr. 26, 1201-2(1955) Dec.

It was found that proportional counter resolution could be improved by a factor of 3 by using a graphite liner on the counter cathode. (B.J.H.)

2123

G-M COUNTERS FOR HIGH TEMPERATURE OPERATION. L. B. Clark, Sr. (Naval Research Lab., Washington, D. C.). Rev. Sci. Instr. 26, 1202-3(1955) Dec.

A description is given of stable halogen-quenched G-M tubes having transparent nonmetallic conducting films as cathodes. (B.J.H.)

2124

X-RAY DIFFRACTION DATA FROM RADIOACTIVE MATERIALS. R. S. Pease (Atomic Energy Research Establishment, Harwell, Berks, England). Rev. Sci. Instr. 26, 1204(1955) Dec.

A technique based on the Debye-Scherrer photographic method was used to obtain x-ray-diffraction data from irradiated fissile materials. Simple removal of β rays has proved sufficient to obtain photographs. (B.J.H.)

2125

COINCIDENCE SORTER FOR SCINTILLATION SPECTROMETERS. Lee Grodzins (Brookhaven National Lab., Upton, N. Y.). Rev. Sci. Instr. 26, 1208-9(1955) Dec.

A technique to record all coincidences and associated pulse heights simultaneously on photographic film is described. A block diagram of the coincidence sorter is given. (B.J.H.)

2126

DETAILED PREPARATION OF CATHODES FOR MICA WINDOW G-M COUNTERS. F. Yenicay (Univ. of Istanbul, Turkey). Rev. Sci. Instr. 26, 1210(1955) Dec.

Refer also to abstracts 2046 and 2102.

MESONS

2127 AECU-3127

Washington Univ., St. Louis.

A CLOUD CHAMBER STUDY OF THE SECONDARY PARTICLES FROM LOCALLY PRODUCED PENETRATING SHOWERS (thesis). Technical Report No. 20. Norman Frederick Harmon. Sept. 1955. 146p. Sponsored by AEC and ONR under Contract N6-ONR-202, Task Order III.

The properties and decay processes of heavy unstable particles have been studied with the use of a multi-plate cloud chamber. The source of high energy primary particles was cosmic rays. Analytical procedures and experimental apparatus and techniques are described. Observed events are discussed in which some significant departure from what is normally observed occurred. (M.P.G.)

2128

THE MEAN LIFETIME AND SOME PROPERTIES OF θ^0-

PARTICLES: A CORRECTION TO PREVIOUSLY PUBLISHED DATA. D. B. Gayther (Univ. of Manchester, England). Phil. Mag. (7) 46, 1362-4(1955) Dec.

Corrected data are presented on the mean lifetime of θ^0 particles and the differential energy spectra for θ^0 and Λ^0 particles. The effects of the corrections on θ^0 and Λ^0 production data are discussed. (M.P.G.)

2129

NUCLEAR CAPTURE OF NEGATIVE K MESONS IN EMULSION. W. F. Fry, J. Schneps, G. A. Snow, and M. S. Swami (Univ. of Wisconsin, Madison). Phys. Rev. 100, 1448-55(1955) Dec. 1.

Thirty stars produced by stopped negative K mesons were found by area scanning in pellicles exposed to the Berkeley Bevatron accelerator. The ratio K^-/π^- at 90° to the incident 6.2-Bev proton beam was found to be $(0.76 \pm 0.11) \times 10^{-4}$ for an average momentum of 240 Mev/c. In four cases, charged hyperons were emitted from the stars, of which three are interpreted as Σ^+ hyperons and one as a Σ^- hyperon. In two additional cases the stopped K^- meson produced a hyperfragment. From 8 of the 30 stars, charged π mesons were emitted. The 30 events are all consistent with the production of a neutral or a charged hyperon upon the absorption of the K^- meson. The production ratio of Σ hyperons to Λ^0 hyperons is estimated to be of the order of 9/21. (auth)

2130

UNSTABLE $_1H^4$ FRAGMENT FROM THE CAPTURE OF A Σ^- HYPERON. Marcel Schein, D. M. Haskin, and Daniel Leenov (Univ. of Chicago). Phys. Rev. 100, 1455-6 (1955) Dec. 1.

A $10 \times 15 \times 5$ cm stack of Ilford G-5 emulsion was exposed to the 3.0-Bev π^--meson beam of the Berkeley Bevatron. A number of events involving K mesons, hyperons, and hyperfragments have been observed. One interesting case is discussed here. A nine prong star is produced by a π^--meson, from which a Σ^- hyperon emerges. This in turn produces a star with three visible prongs, one of which is a $_1H_4$-hyperfragment decaying into two visible colinear tracks, one of which has been identified as a π^- meson. This π^- meson was followed to the end of its range, and its energy was determined to be 51 ± 1 Mev, making it possible to calculate a reliable value for the binding energy of the Λ^0 in the fragment. The result yielded 3.3 ± 1 Mev. Analysis of the particles emerging from the Σ^- star showed that momentum balance could be achieved by assuming emission of a high-energy neutron, whose calculated energy of 41 Mev agrees well with the energy of 42 Mev for a neutron produced in the postulated elementary interaction $\Sigma^- + p \rightarrow \Lambda^0 + n + Q$. (auth)

2131

REACTION $\pi^- + d \rightarrow 2n + \pi^0$; PARITY OF THE NEUTRAL MESON. W. Chinowsky and J. Steinberger (Columbia Univ., New York). Phys. Rev. 100, 1476-9(1955) Dec. 1.

The branching ratio between the capture reactions $\pi^- + d \rightarrow 2n + \pi^0$ and $\pi^- + d \rightarrow 2n + \gamma$ has been determined to be $< 0.1\%$. Comparison with the previously measured branching ratio between the corresponding processes in hydrogen provides strong evidence for pseudoscalar π^0 parity. (auth)

2132

NOTE ON THE DECAY AND ABSORPTION OF THE θ^0. A. Pais (Columbia Univ., New York and Brookhaven National Lab., Upton, N. Y.) and O. Piccioni (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 100, 1487-9(1955) Dec. 1.

A suggestion is made on how to verify experimentally a recent theoretical suggestion that the θ^0 meson is a "particle mixture." (auth)

2133

ELECTRONS FROM MUON CAPTURE. J. Steinberger and Harry B. Wolfe (Columbia Univ., New York). Phys. Rev. 100, 1490-3(1955) Dec. 1.

A search was made for the process $\mu^- + p \rightarrow p + e^-$ or $\mu^- + n \rightarrow n + e^-$ for μ mesons stopped in a Cu target. Scintillation counters were employed to detect the electrons from the process. No counts attributable to the electrons were obtained and an upper limit of $\sim 5 \times 10^{-4}$ for the relative rate of this process to that for the usual nuclear capture reaction is determined. (auth)

2134

SCATTERING OF PIONS BY NUCLEONS IN INTERMEDIATE COUPLING. M. H. Friedman and T. D. Lee (Columbia Univ., New York) and R. Christian (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 100, 1494-1501(1955) Dec. 1.

An intermediate-coupling method of calculation is applied to the meson-nucleon scattering problem for the case of symmetric pseudoscalar mesons, coupled to a fixed extended source through derivative coupling. It is found that the experimentally observed P-wave phase shifts can be explained by taking the coupling constant $f^2 = 0.712$ and the cutoff $\omega_{max} = 6.21$ meson masses. (This corresponds to a renormalized coupling constant $f_r^2 = 0.105$.) (auth)

2135

SPIN OF THE τ^+ MESON. B. T. Feld, A. C. Odian, D. M. Ritson, and A. Wattenberg (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 100, 1539-40(1955) Dec. 1.

In order to determine the spin and parity of τ^+ mesons, the decay of 54 τ^+ mesons was studied. Preliminary reports are made on the angular correlation and energy distribution of the decay products. Results favor spin 1 and even parity for the τ^+ meson. (B.J.H.)

2136

ANGULAR DISTRIBUTION OF Λ^0 AND θ^0 DECAYS. Robert K. Adair (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 100, 1540-1(1955) Dec. 1.

It is pointed out that a determination of the angular distribution of those Λ^0 decays which are in coincidence with θ^0 mesons which decay in the forward or backward direction, uniquely determines the Λ^0 spin. Likewise a measurement of the decay distribution of those θ^0 mesons in coincidence with Λ^0 particles which decay in the forward or backward direction will determine the θ^0 spin. General expressions are given. (B.J.H.)

2137

ANOMALOUS NEUTRAL V-PARTICLES. W. H. Arnold, Jr., W. Martin, and H. W. Wyld (Princeton Univ., N. J.). Phys. Rev. 100, 1545-7(1955) Dec. 1.

An analysis was made of 82 neutral V particles in a search for anomalous neutral decays. Data on five anomalous V particles are tabulated. (B.J.H.)

2138

CAPTURE OF K^--MESON WITH EMISSION OF HIGH-ENERGY ELECTRON AS THE ONLY VISIBLE PRONG. D. B. Williams, D. M. Haskin, M. Koshiba, and Marcel

Schein (Univ. of Chicago). Phys. Rev. 100, 1547-8(1955) Dec. 1.

An analysis is made of an event occurring in a nuclear emulsion exposed to the K^- beam of the Berkeley Bevatron. The event consisted of a K^- capture which ejects a high-energy electron as the only visible track. This is believed to be the first reported case of this type of star. (B.J.H.)

Refer also to abstract 2101.

MOLECULAR PROPERTIES

Refer to abstract 2226.

NEUTRONS

2139 IDO-16067

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

THE AGE IN BERYLLIUM–WATER MIXTURES. H. L. McMurry. Mar. 5, 1953. Decl. Sept. 28, 1955. 19p. Contract [AT(10-1)-205].

This report gives preliminary values for the age of fission neutrons at thermal energy in homogeneous beryllium–water mixtures. The computations were made by modifying the age formula for continuous slowing down of neutrons so that it gives the experimental ages in pure water and pure beryllium. Two methods for doing this are described. They yield ages which differ by nearly 15% in the range of 30 to 40% water by volume. For this reason the results are considered to be preliminary pending more exact calculations. Curves are given showing the variation of age at thermal energy with % water by volume in the ranges 0 to 5% and 0 to 100%, using both approaches. In particular, one method gives 91 and 88 cm^2 for two and three % water by volume, respectively, and the other gives 93 and 91 cm^2 for these percentages. The MTR Handbook gives 89 cm^2 for 2% water. An appendix presents a derivation of the age formula for a homogeneous system composed of different types of atoms. The derivation and the final formula are not given in the usual texts. (auth)

2140

SMALL-ANGLE SCATTERING OF NEUTRONS BY INTERMEDIATE AND HEAVY NUCLEI. S. E. Darden, R. B. Perkins, and R. B. Walton (Univ. of Wisconsin, Madison). Phys. Rev. 100, 1315-17(1955) Dec. 1.

Differential cross sections for scattering of neutrons at forward angles have been measured at three energies for several elements. The results are compared with predictions of the complex square well potential of Feshbach, Porter, and Weisskopf. (auth)

2141

RADIATION WIDTHS IN SLOW NEUTRON RESONANCES. H. H. Landon (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 100, 1414-18(1955) Dec. 1.

A summary of current measurements of total radiation widths as observed in slow neutron resonance capture is presented together with the most recent data for a number of resonances in iridium, lutetium, and tungsten. The general features of the dependence of radiation width upon atomic weight is discussed in terms of a model proposed by Blatt and Weisskopf. (auth)

Refer also to abstracts 2146 and 2190.

NUCLEAR PHYSICS

2142 AECD-3691

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

MTR TECHNICAL BRANCH QUARTERLY REPORT [FOR] FIRST QUARTER—1955. J. R. Huffman. June 20, 1955. Decl. with deletions Oct. 6, 1955. 37p. Contract AT(10-1)-205.

The $Ni^{58}(n,p)Co^{58}$ reaction was observed, and the γ spectrum of the irradiated NiO sample is given. The thermal neutron activation cross section of Np^{237} was found. A preliminary estimate of the pile neutron capture cross section of Au^{199} was obtained, and a beta decay curve for Au^{200} was given. A NaI crystal "well" counter was used to obtain γ spectrum analyses of neutron-activated stainless steel. The ratio of electron capture to positron emission for Co^{58} was obtained. The perturbation of neutron flux in the VH-3 facility by a Cd rabbit was studied. Instrumentation now being employed with the Reactivity Measurement Facility is described. Block and instrumentation diagrams are given for the MTR activated wire scanner. A procedure for determining the amount of U^{235} in irradiated samples by counting delayed neutrons has been demonstrated. Preliminary plans and results for a fuel loading computor for use with the MTR are discussed. (B.J.H.)

2143

EXCITED STATES OF NUCLEONS. I. I. Gurevich. Doklady Akad. Nauk S.S.S.R. 105, 69-72(1955) Nov. 1. (In Russian)

The work is concerned with the further development of the theory of hyperon formation from the study of states of excitation of nucleons. Only the metastable states of the nucleon with the mean life of $\leq 10^{-11}$ sec are discussed. (R.V.J.)

2144

ENERGY SPECTRUM OF NEUTRONS FROM SPONTANEOUS FISSION OF CALIFORNIUM-252. Elis Hjalmar, Hilding Slatis, and Stanley G. Thompson (Nobel Inst. of Physica, Stockholm). Phys. Rev. 100, 1542-3(1955) Dec. 1.

The source used was prepared by evaporation on a thin platinum foil and covered by another foil to prevent α-particle escape. The source was placed on a nuclear emulsion, and after exposure of the plate to the neutrons, the emulsion was examined for proton recoils. The resultant energy spectrum of neutrons from the spontaneous fission of Cf^{252} is given. The number of neutrons per fission was found to be 3.87. (B.J.H.)

2145

ANGULAR DISTRIBUTION OF GAMMA RAYS IN COULOMB EXCITATION. F. D. Benedict and G. Tice (Yale Univ., New Haven, Conn.). Phys. Rev. 100, 1545(1955) Dec. 1.

Calculations of the a_2 angular correlation coefficient for Coulomb excitation of the 330-kev level in Pt^{194} were expanded to include a_4. Similar calculations were made for the 550-kev level of Cd^{114}. Theoretical results are plotted together with experimental values. (B.J.H.)

NUCLEAR PROPERTIES

2146 NRL-4666

Naval Research Lab., Washington, D. C.

TOTAL CROSS SECTIONS FOR 14-MEV NEUTRONS—COMPARISON OF MEASURED VALUES WITH VALUES

CALCULATED FROM THE COMPLEX SQUARE-WELL MODEL. W. I. McGarry, J. O. Elliott, and W. R. Faust. Nov. 4, 1955. 6p. Project NR 661-100.

A comparison has been made between measured 14-Mev neutron total cross sections and theoretical values calculated from the complex square-well model of the nuclear interaction for Bi, Ta, In, Fe, and S. The theoretical parameters used in the calculations were obtained from previous work on 14-Mev neutron differential elastic cross sections. The comparison shows that the calculated cross sections are low indicating either that a greater nuclear radius parameter is required (in contradiction with the differential elastic scattering data) or that the theoretical model utilizing a square well is an oversimplification. (auth)

2147 OSR-TN-55-447

Yale Univ., New Haven.

NOTE ON GAMMA ANGULAR DISTRIBUTION IN COULOMB EXCITATION. G. Breit, M. E. Ebel, and J. E. Russell. Oct. 27, 1955. 12p. Project R-357-40-8. Contract AF18(600)-771.

In view of discrepancies in the literature regarding signs in formulas for the angular distribution of gamma rays emitted in Coulomb excitation, this distribution is worked out for the special case of $0 \rightarrow 2$ transitions. The calculation is quantum mechanical and neglects higher than first order effects in the Coulomb energy. The signs and forms obtained are confirmed by a semi-classical calculation. (auth)

2148

NUCLEAR ORIENTATION OF CERIUM-141. C. F. M. Cacho, M. A. Grace, C. E. Johnson, A. C. Knipper, R. G. Scurlock, and R. T. Taylor (Clarendon Lab., Oxford, England). Phil. Mag. (7) 46, 1287-94(1955) Dec.

Ce^{141} has been aligned by the method of magnetic hfs (alignment) in a crystal of cerium ethyl sulfate. From measurements of the angular distribution and the plane of polarization of the γ radiation it is concluded that the γ-ray transition is principally M1 with a small admixture of E2 ($\delta = +0.08 \pm 0.02$). Values of 0.75 ± 0.20 and 0.66 ± 0.16 nuclear magnetons are found for the nuclear moment of Ce^{141}, depending on whether the β transition involves a spin change of 1 or 0. (auth)

2149

COULOMB EXCITATION OF TELLURIUM AND SILVER. L. W. Fagg, E. A. Wolicki, R. O. Bondelid, K. L. Dunning, and S. Snyder (Naval Research Lab., Washington, D. C.). Phys. Rev. 100, 1299-1302(1955) Dec. 1.

Coulomb excitation has revealed gamma rays at 159, 274, 342, 436, and 504 kev in Te^{123}; 435 and 633 kev in Te^{125}; 319 and 419 kev in Ag^{107}; and 306 and 412 kev in Ag^{109}. Interpretation of these results in conjunction with excitation curves and coincidence measurements is discussed in terms of proposed energy level schemes. In the case of Te^{123} it is concluded that three levels are independently excited. Values are given for the quadrupole moments, Q_0, based on the Bohr-Mottelson unified model and for the reduced transition probabilities for excitation, $B_e(E2)$. (auth)

2150

ENERGY LEVELS OF S^{33}, S^{35}, Cl^{36}, Cl^{38}, AND Ba^{139}. C. H. Paris, W. W. Buechner (Massachusetts Inst. of Tech., Cambridge) and P. M. Endt (Physisch Laboratorium der Rijksuniversiteit, Utrecht, Netherlands). Phys. Rev. 100, 1317-23(1955) Dec. 1.

Barium chloride targets have been bombarded with deuterons accelerated by an electrostatic generator to energies between 3.0 and 7.5 Mev. Charged reaction products have been observed with a high-resolution magnetic analyzer. The following ground-state Q values have been measured: $Cl^{35}(d,\alpha)S^{33}$, 8.277 ± 0.010 Mev; $Cl^{37}(d,\alpha)S^{35}$, 7.783 ± 0.012 Mev; $Cl^{35}(d,p)Cl^{36}$, 6.354 ± 0.008 Mev; and $Cl^{37}(d,p)Cl^{38}$, 3.881 ± 0.008 Mev. Fifteen levels have been observed in S^{33}, four in S^{35}, twenty-three in Cl^{36}, and six in Cl^{38}. From the intensities of the observed proton groups and other considerations, a spin of $J = 2^-$ can be assigned to the Cl^{38} ground state, and a spin of $J = 5^-$ to the lowest (isomeric) level in Cl^{38} at 672 ± 5 kev. The $Ba^{138}(d,p)Ba^{139}$ ground-state Q-value is 2.493 ± 0.010 Mev, and a level in Ba^{139} is observed at 623 ± 8 kev. (auth)

2151

SLOW NEUTRON RESONANCES IN RHENIUM. G. Igo (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 100, 1338-9(1955) Dec. 1.

The BNL crystal spectrometer has been used to investigate the total cross section of rhenium for neutrons of energy 1 ev to 13 ev. Reasonances were detected at 2.156, 4.416, 5.90, 7.2, 11.1, 11.9, and 12.8 ev. Two resonances were analyzed to obtain the parameters of the Breit-Wigner single-level formula. The radiation widths measured in this experiment are in agreement with the general trend in radiation widths near A = 185. A new resonance was observed at 11.9 ev. (auth)

2152

SURVEY OF (p,n) REACTIONS AT 12 MEV. H. G. Blosser and T. H. Handley (Oak Ridge National Lab., Tenn.). Phys. Rev. 100, 1340-4(1955) Dec. 1.

Results of measurements of twenty (p,n) cross sections on elements from atomic number 21 to 58 are given. The data indicate total reaction cross sections which, when interpreted in terms of a totally black square well potential of depth 20 Mev, correspond to a potential radius of 1.55 to $1.65A^{1/3} \times 10^{-13}$ cm. (auth)

2153

INTERNAL CONVERSION ELECTRONS FROM ELECTRIC EXCITATION OF Ta^{181}, Au^{197}, AND Pt^{195}. E. M. Bernstein and H. W. Lewis (Duke Univ., Durham, N. C.). Phys. Rev. 100, 1345-50(1955) Dec. 1.

Conversion electrons from the electric excitation of Ta^{181}, Au^{197}, and Pt^{195} have been studied with a magnetic spectrometer. From K/L ratios, multipolarities have been assigned to the following transitions: Ta 137 kev, 0.93 M1 + 0.07 E2; Au 279 kev, 0.75 M1 + 0.25 E2; Pt 210 kev, M1. Direct excitation of the 77-kev level in Au has been observed with a reduced transition probability for excitation of $(0.18 \pm 0.06) \times 10^{-48}$ cm^4 e^2. Measured excitation functions indicate levels in Pt at 29 and 126 kev, instead of at 97 and 126 kev, as assigned from radioactive decay studies. Apparent single-particle transitions in Au and Pt have E2 transition probabilities an order of magnitude larger than single-particle estimates. (auth)

2154

ANGULAR CORRELATION MEASUREMENTS IN Te^{121} AND Te^{123}. Norman Goldberg and Sherman Frankel (Univ. of Pennsylvania, Philadelphia). Phys. Rev. 100, 1350-4 (1955) Dec. 1.

Measurements of the angular correlation of the two-step transition in Te^{121} and Te^{123} have been made using a thin Te source ($<1\mu g/cm^2$). K conversion electron-gamma, L conversion electron-gamma and K conversion-K conversion cascades were investigated in both isomers using a thin lens beta spectrometer as the fixed detector and scintillation counters for the movable detector. The measured correlation was found to be of the form $1 + A_2P_2(\cos\theta)$ in agreement with the theoretically predicted angular correlation for the known spin sequence in the tellurium isomers ($11/2 \rightarrow 3/2 \rightarrow 1/2$). The measured values of A_2 corrected for geometry are -0.097 ± 0.004, -0.092 ± 0.009, -0.06 ± 0.03 for the K-γ, L-γ, and K-K cascades respectively in Te^{123} and -0.015 ± 0.007, -0.007 ± 0.007, and -0.10 ± 0.04 for the same cascades in Te^{121}. Comparison of the results of the K-γ cascades with theory shows that the second transition is a mixture of $(1.3 \pm 0.1)\%$ E2 and 98.7% M1 in Te^{123} and $(5.6 \pm 0.5)\%$ E2 and 94.4% M1 in Te^{121}. The ratio of reduced matrix elements is plus in both cases using the Biedenharn and Rose notation. The results for the K-K angular correlation are consistent with the K-γ correlations and are used to prove that the correlations, which are small than the M4−M1 correlation, cannot result from reduction of the M4−M1 correlation by the action of extra-nuclear fields. (auth)

2155

FIRST EXCITED STATE OF Mn^{55}. E. M. Bernstein and H. W. Lewis (Duke Univ., Durham, N. C.). Phys. Rev. 100, 1367-8(1955) Dec. 1.

The spin of the first excited state of Mn^{55} at 128 kev has been measured in the electric excitation process with 3-Mev alpha particles. Determinations of the K conversion coefficient and the angular distribution of the γ rays lead to a spin assignment of $^7/_2^-$ for the excited state and multipolarity M1 for the transition to the ground state. The K conversion coefficient ($\alpha_K = 0.0144 \pm 0.003$) was measured by comparison with the known coefficient of the 137-kev transition in Ta^{181}. The spin, parity, and transition probability are consistent with those expected for a rotational state. (auth)

2156

NUCLEAR MOMENTS OF Mo^{95}, Mo^{97}, Zr^{91}, I^{127}, Sb^{121}, AND Sb^{123}. Kiyoshi Murakawa (Institute of Science and Technology, Tokyo, Japan). Phys. Rev. 100, 1369-72(1955) Dec. 1.

The hyperfine structure (hfs) of the spectrum of Mo I was studied, and it was found that both Mo^{95} and Mo^{97} have nuclear spins equal to $^5/_2$. Substituting this in the g-values of Mo^{95} and Mo^{97} given in the literature, the magnetic moments $\mu(Mo^{95}) = -1.2736$ nm and $\mu(Mo^{97}) = -1.3006$ nm (without diamagnetic correction) are obtained. Hfs investigation of the spectrum of Zr I yielded the result that $\mu(Zr^{91}) = -1.9 \pm 0.2$ nm. The quadrupole moment of I^{127} as derived from the hfs of the visible spectrum and as derived from the atomic beam resonance technique published in the literature is discussed, and it is concluded that $Q(I^{127}) = (-0.69 \pm 0.03) \times 10^{-24}$ cm^2 including the polarization correction due to Sternheimer. Data concerning the hfs of the spectrum of Sb II are discussed, and it is shown that they support the values $Q(Sb^{121}) = (-0.53 \pm 0.10) \times 10^{-24}$ cm^2 and $Q(Sb^{123}) = (-0.68 \pm 0.10) \times 10^{-24}$ cm^2 (including the polarization correction) that were deduced previously. (auth)

2157

INELASTIC PROTON SCATTERING FROM VANADIUM. W. W. Buechner, C. M. Braams, and A. Sperduto (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 100, 1387-90(1955) Dec. 1.

The low-lying excited states of V^{51} have been investigated by means of inelastic proton scattering. Protons were accelerated to 6.0, 7.0, and 7.4 Mev in the MIT-ONR electrostatic generator, and the scattered protons were analyzed with a broad-range magnetic spectrograph, observations being made at 90 and 130 degrees to the incident beam. Proton groups were found which corresponded with levels in V^{51} at 0.322 ± 0.002, 0.931 ± 0.003, 1.614 ± 0.005, and 1.819 ± 0.05 Mev. A large number of lower energy groups were observed, which are associated with excited states between 1.85 and 4.50 Mev. Two groups of alpha particles were also observed and assigned to the ground state and first excited state formed in the $V^{51}(p,\alpha)Ti^{48}$ reaction (Q = 1.161 and 0.167 Mev). (auth)

2158

NUCLEAR LEVELS OF Lu^{175}. J. P. Mize, M. E. Bunker, and J. W. Starner (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 100, 1390-6(1955) Dec. 1.

The negatron decay of Yb^{175} (4.2 day) and orbital electron capture decay of Hf^{175} (70 day) to Lu^{175} have been investigated in detail using a magnetic lens spectrometer, 180° permanent magnet spectrographs, scintillation spectrometers, and coincidence techniques. Eleven γ transitions in Lu^{175} of the following energies and indicated multipolarities have been observed: 89.3 (M1 + E2), 113.6 (M1 + E2), 137.6, 144, 229.3 (E2), 251, 282.4 (E1 + M2), 318.6, 342.9 (M1 + E2), and 432.2 kev. On the basis of these measurements, consistent decay schemes for Yb^{175} and Hf^{175} are proposed. Observed nuclear levels in Lu^{175} excited by the radioactive decay of these two nuclides occur at 113.6, 251.2, 342.9, 396.0, and 432.2 kev and are assigned spin and parity values $^9/_2+$, $^{11}/_2+$, $^5/_2+$, $^9/_2-$, and $^5/_2+$, respectively. The levels at 113.6 kev and 251.2 kev constitute a rotational band whose base state occurs at stable Lu^{175} ($^7/_2+$). (auth)

2159

SPECTROMETRY OF THE NEUTRINO RECOILS OF ARGON-37. Arthur H. Snell and Frances Pleasonton (Oak Ridge National Lab., Tenn.). Phys. Rev. 100, 1396-1403 (1955) Dec. 1.

The ions that recoil from neutrino emission in the electron capture decay of A^{37} have been subjected to magnetic spectrometry with a resolution amounting to 2.8% in energy. They are found to have an energy of 9.63 ± 0.06 ev, which is in agreement with the value 9.65 ± 0.05 ev to be expected on the basis of a two-body breakup, the neutrino having an energy of 815 ± 2 kev as determined by others from the threshold of the $Cl^{37}(p,n)A^{37}$ reaction. The momentum balance sets an upper limit of about 5 kev for the rest mass of the neutrino. Auger electron emission following the orbital electron capture leaves the recoils mostly multiply charged, the percentage abundances in charge states 1 to 7 being 6.2 ± 0.1, 15.7 ± 0.4, 39.2 ± 0.5, 26.7 ± 0.4, 10.0 ± 0.2, 1.8 ± 0.1 and 0.4 ± 0.1, respectively. Neutrals were not measured. The natural width at half-intensity of the singly-charged recoil line is 1.7 ev, which is fully accounted for by the thermal motion of the argon atoms. The natural width of the triply-charged recoil line is 2.5 ev, which is mostly but not entirely accounted for

by thermal motion plus recoil from the emission in one 2300-ev K Auger electron. The singly-charged recoils are thought to result from L-capture and from K-capture followed by K x-ray emission, neither of these processes involving recoil from the 2300-ev Auger electron. (auth)

2160

INELASTIC SCATTERING OF 19-MEV PROTONS BY O^{16}. W. F. Hornyak and R. Sherr (Princeton Univ., N. J.). Phys. Rev. 100, 1409-14(1955) Dec. 1.

The NaI scintillation spectroscopy of the proton groups from the inelastic scattering of 19-Mev protons by O^{16} yielded levels in O^{16} at 6.14, 7.02, 8.87, 9.85, 10.34, 11.08, 11.51, 12.02, 12.53, 13.06, and possibly 13.39 Mev, with an error of ±30 kev. The levels at 8.87 and 11.08 Mev are probably 2^- in character and are found to decay by γ rays cascading through the states at 6 and 7 Mev. The relatively weakly excited level at 12.02 Mev is probably accompanied by γ-ray emission. Differential cross sections for most inelastic groups are also given. (auth)

Refer also to abstracts 2228, 2229, and 2236.

NUCLEAR REACTORS

2161 AECD-3681

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

NEUTRON FLUX DISTRIBUTIONS IN THE MATERIALS TESTING REACTOR. PART III. FUEL BURNOUT IN THE 3 × 9 LOADING. G. O. Bright. July 27, 1954. Decl. with deletions Oct. 5, 1955. 48p. Contract AT-(10-1)-205.

The distribution of fuel burnout in the Materials Testing Reactor after the first operating cycle has been computed. The work involves the use of flux distribution functions which were obtained experimentally during the acceptance testing period of the reactor. A process of numerical integration is used which yields results compatible with the accuracy of the experimental data. The results are shown as a set of curves in which each fuel element and fuel-bearing shim-safety rod is represented. (auth)

2162 AECD-3682

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

FACILITIES FOR IRRADIATIONS WITHIN THE MTR REACTOR TANK. C. F. Leyse. June 5, 1953. Decl. with deletions Oct. 15, 1955. 72p. Contract AT-(10-1)-205.

Information is provided on the following experimental facilities in the Materials Testing Reactor: reactor tank experimental access holes; reactor lattice facilities; Be reflector facilities; hydraulic rabbits; and pneumatic rabbits. Neutron fluxes, γ heating, and process water flow are also discussed. (M.P.G.)

2163 AECU-3062

Division of Reactor Development, AEC.

FEASIBILITY STUDY OF PRESSURE VESSELS FOR NUCLEAR POWER GENERATING REACTORS. Frank W. Davis, comp. Dec. 1955. 372p.

Included are the designs, cost estimates, and fabrication procedures for four pressurized water reactor vessels. Some general remarks on closures and fatigue tests are also given. (B.J.H.)

2164 DL-19

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

ECONOMIC POWER FUELING WITHOUT U-235 ENRICHMENT. W. B. Lewis. Dec. 1955. 24p. (AECL-265)

The economic feasibility of fueling power reactors without U^{235} enrichment is discussed. The alternate methods of using U only once or reprocessing and recycling U and Pu are compared. It is concluded that, under certain conditions, either scheme could be practicable if used in heavy water moderated and cooled thermal neutron reactors where there is low neutron wastage. (M.P.G.)

2165 IDO-16114

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

A NON-DESTRUCTIVE METHOD FOR FUEL ASSAYING. S. G. Forbes. Sept. 22, 1953. Decl. Sept. 12, 1955. 30p. Contract AT(10-1)-205.

A low cost facility for the non-destructive assay of fuel assemblies has been developed at the MTR. The method consists of measurements of the fission rate and thermal neutron transmission for a fuel assembly placed in a thermal neutron beam. An analysis of the errors involved indicates accuracies of 1 to 2% should be possible. Statistical data on 122 fuel assemblies shows a standard deviation of about 1% per assembly and an accumulated error in total fuel content of about ½%. (auth)

2166 IDO-16180

Phillips Petroleum Co. Atomic Energy Div.

METHODS FOR CALCULATING LARGE REACTIVITY CHANGES IN THE MTR. H. L. McMurry. July 26, 1954. 19p. Contract AT(10-1)-205.

Two bases for computing large reactivity changes due to burnout and fission product poisons are developed. In one, the "variable η" method, the reactor is assumed to operate with a fictitious η such that it is always critical with the cadmium removed from the core. Expressions, based on perturbation theory, can then be derived for the total reactivity change during operation. In a similar manner, if η is assumed to vary as poison is added to the core so the reactor is always critical with the cadmium removed, an expression for the reactivity change due to poison addition can be obtained. Calculations based on these two equations involving the operating time and the amount of poison to completely poison the core, respectively, can then be compared. The second method, the "variable poison" method, assumes the core with fresh fuel to be uniformly poisoned so the reactor is critical with all cadmium withdrawn. As the reactor operates the uniform poison is imagined to be removed so criticality is always maintained with the cadmium out. On this basis expressions giving the reactivity changes due to fuel consumption and fission products, and to poison removal can be derived. (auth)

2167 JENER-37

Joint Establishment for Nuclear Research, Kjeller, Norway.

SOME COMMENTS ON THE HAZARDS ARISING FROM FISSION-PRODUCT HEAT IN THE EVENT OF AN ACCIDENT TO A HEAVY WATER BOILING REACTOR. J. P. Davidson. Sept. 1955. 13p.

Certain interest attaches to the question of what hazards would arise, in the event of an accident to a pressurized water boiling reactor system, from the continuing heat

generation from the fission products. In a general discussion such as this it would seem that one can distinguish two different situations. In the first, and perhaps less probable, one may assume that the water moderating the system suddenly disappears at some time t_0. In this case fission stops almost at once in the fuel elements, the disappearing water carries with it a vast amount of energy, and one deals only with the heat arising from the beta and gamma decays of the fission products. In the second case one may suppose that the pressure is suddenly relieved. Here, as shall be seen, a large amount of heat is available to vaporize the moderator, and in addition, heat is available in the fuel elements both in the thermal form (instantaneously) and from the fission products. (auth)

2168 TID-5292

Technical Information Service, AEC.
USAEC INDUSTRIAL PARTICIPATION GROUP PROGRAM—HISTORY AND ACCOMPLISHMENTS, MAY 1951—APRIL 1955. Dec. 15, 1955. 78p.

The accomplishments are reviewed of 16 industrial study groups actively engaged during the period from May 1951 to April 1955 in determining the most promising reactor concepts for industrial power applications. A bibliography of reports issued by the study groups is appended. (C.H.)

2169 ORNL-692

Oak Ridge National Lab., Tenn.
PROCEDURE FOR ERECTION OF THE MATERIALS TESTING REACTOR MOCK-UP. S. E. Beall. May 18, 1950. Decl. Sept. 20, 1955. 33p. Contract W-7405-eng-26.

The stepwise assembly procedure of all reactor parts exclusive of the structure and water system are described for the erection of the Materials Testing Reactor Mockup. (C.H.)

2170

UNIQUE URANIUM REPROCESSING PLANT DESIGNED FOR DIRECT MAINTENANCE. Chem. Eng. 63, No. 1, 120, 122(1956) Jan.

The design and operation of the fuel reprocessing plant (ICPP) located at Idaho Falls, Idaho are discussed. Direct and remote maintenance plants are compared. (C.W.H.)

Refer also to abstracts 2105, 2108, and 2187.

NUCLEAR TRANSFORMATION

2171 LA-1960

Los Alamos Scientific Lab., N. Mex.
[AN ANALYSIS OF Li^6 NEUTRON CROSS SECTIONS]. J[oseph] J. Devaney. [1955]. Decl. Nov. 22, 1955. 30p. Contract [W-7405-eng-36].

An isolated level Breit-Wigner analysis of the neutron elastic scattering and $Li^6(n,t)He^4$ cross section over the region 0 to 0.5 Mev is presented. In order to more accurately depict these cross sections the effect of six levels from -0.5193 to 3.52 Mev neutron energy was considered; thus cross sections to 3.0 Mev were studied. The parameters of the theory were obtained directly from experiment, from fitting experimental cross-section curves, and from the predictions of other theories. (auth)

2172 NP-5849

Naval Research Lab., Washington, D. C.
BIBLIOGRAPHY OF PHOTONUCLEAR REACTIONS. Bibliography No. 2. M. Elaine Toms, comp. June 1955. 62p.

A comprehensive listing of theoretical and experimental papers on photon initiated nuclear transformations published in the standard periodicals is presented. Reports with limited distribution have been omitted. The bibliography consists of 545 references published during or before 1954 and an author index. (M.P.G.)

2173 UCRL-4266

California. Univ., Livermore. Radiation Lab.
INFORMATION ON THE NEUTRONS PRODUCED IN THE $H^3(d,n)He^4$ REACTION. Jack Benveniste and Jerry Zenger. Jan. 1954. 32p. Contract W-7405-eng-48.

A compilation of tables and graphs of the more important kinematical relations describing the D-T reaction is presented. Information is included on the differential cross section for the production of neutrons in the $H^3(d,n)He^4$ reaction, proton and deuteron energy loss in various materials, total neutron production per detected α particle, and neutron line shape. (M.P.G.)

2174

NEUTRON-CAPTURE GAMMA-RAY SPECTRA OF V, Co, Ti, Fe, Cr, Au, Mn, AND I. Melvin Reier (Brookhaven National Lab., Upton, N. Y.) and Morris H. Shamos (New York Univ., N. Y.). Phys. Rev. 100, 1302-8(1955) Dec. 1.

An experiment has been performed on the neutron-capture gamma spectra of eight elements in the region of about 100 kev to 2.5 Mev using NaI crystals. Wherever possible, the data have been compared with the results of previous experiments and existing energy level schemes. (auth)

2175

PROTONS FROM THE BOMBARDMENT OF SEVERAL ELEMENTS WITH 40-MEV ALPHA PARTICLES. R. M. Eisberg, G. Igo, and H. E. Wegner (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 100, 1309-14(1955) Dec. 1.

Thin targets of Au, Ag, and Cu were bombarded with 40-Mev alpha particles, and the energy distributions of protons emitted at 150° were measured. According to the compound-nucleus model, the level density of the residual nucleus is equal to: const $N/E\sigma_c$, where N is proportional to the probability that the compound nucleus emits a proton of energy E, and σ_c is the cross section for the inverse reaction. For each element, $\log(N/E\sigma_c)$ plotted as a function of the excitation energy of the residual nucleus, E_r, is concave downward. This is in qualitative agreement with the Fermi gas level density formula: const $\exp(AE_r)^{1/2}$. For Au, $N/E\sigma c$ fits this formula with $A = 5.8$ Mev^{-1} when $E_r > 2$Mev; when $E_r < 2$ Mev, $N/E\sigma c$ increases less rapidly with increasing E_r than the formula. For Ag, $N/E\sigma_c$ fits with $A = 4.7$ Mev^{-1} for all E_r. For Cu, $N/E\sigma_c$ fits with $A = 5.6$ Mev^{-1} when $E_r > 4.5$ Mev; when $E_r < 4.5$ Mev, $N/E\sigma_c$ increases more rapidly than the formula. In the region of 15°, the cross section for the emission of lower-energy protons is isotropic, but the cross section for high-energy protons decreases slightly with increasing angle. Thus the energy distributions in the region of small E_r, are probably contaminated with protons from noncompound-nucleus processes. (auth)

2176

PHOTODISINTEGRATION OF C^{12} AND O^{16}. F. I. Havlicek and B. Dobovisek (J. Stefan Inst., Ljubljana, Yugoslavia). Phys. Rev. 100, 1355-7(1955) Dec. 1.

Measurements have been carried out on the distribution in energy and angle of the alpha particles from 485 C^{12} and 57 O^{16} disintegrations induced by bremsstrahlung of 27- and 33-Mev maximum energy. These measurements yield information on the energy levels in Be^{8}, C^{12}, and O^{16}. (auth)

2177

$C^{12}(\gamma,n)$ YIELD CURVE NEAR THRESHOLD. B. M. Spicer and A. S. Penfold (Univ. of Illinois, Urbana). Phys. Rev. 100, 1375-6(1955) Dec. 1.

The $C^{12}(\gamma,n)$ yield curve has been studied near the threshold for the reaction with a 22-Mev betatron. A discontinuity in slope, or "break," is observed to occur 370 kev above the threshold. This is in disagreement with previously published results. The discrepancy is important since it indicates a disagreement in the measurement of the $C^{12}(\gamma,n)C^{11}$ threshold, and this threshold is used to establish the energy calibration of the betatron. (auth)

2178

DETAILED STUDY OF THE $O^{16}(\gamma,n)O^{15}$ REACTION. A. S. Penfold and B. M. Spicer (Univ. of Illinois, Champaign). Phys. Rev. 100, 1377-86(1955) Dec. 1.

The yield curve for the $O^{16}(\gamma,n)O^{15}$ reaction has been examined in detail over most of the energy region between 15.6 and 23.2 Mev. Fine structure in the form of sudden changes of slope, or "breaks" had been previously reported by the Saskatchewan group. The existence of these breaks was confirmed, and a number of new breaks have been found. The yield curve was analyzed for cross section in the vicinity of a break at 16.03 Mev, and it was found that the cross section has a resonance shape with a width of 18 ± 5 kev. The yield curve breaks are interpreted as manifestations of narrow resonances in the cross section. Integrated cross sections, peak heights, and radiative widths were estimated for all the levels found. On the basis of the radiative widths, it is concluded that, below about 19 Mev the reaction proceeds by absorption of E2 radiation, while between 22 and 23 Mev it proceeds principally by absorption of E1 radiation. No conclusion could be drawn for the 20 to 21 Mev region. From a consideration of the total integrated cross section and the cross section at 17.63 Mev, it is concluded that the bulk of the gamma-ray absorption by O^{16} takes place into narrow levels. (auth)

Refer also to abstracts 2237, 2238, and 2239.

PARTICLE ACCELERATORS

2179 CERN-PS/A-SCH.2

[European Organization for Nuclear Research].
ORBIT STABILITY IN A SYNCHROTRON WITH NON-LINEAR RESTORING FORCES. A. Schoch. May, 1955. 25p.

The nonlinear oscillations of a particle in an alternating gradient synchrotron have been analyzed theoretically. Equations of motion were set up, and an invariant of the motion was derived. The simplified problem of an oscillatory system with one degree of freedom excited by periodically repeated kicks was studied. It was concluded that the derived invariant permits fairly accurate, although approximate, predictions regarding amplitude limits of nonlinear one-dimensional oscillations in the neighborhood of resonances and subresonances. (M.P.G.)

2180 ISC-588

Ames Lab., Ames, Iowa.
DETERMINATION OF THE ANGULAR SPREAD OF THE X-RAY BEAM FROM THE I. S. C. (70-MEV) SYNCHROTRON. Guveren M. Anderson and D. J. Zaffarano. Mar. 1955. 69p. Contract W-7405-eng-82.

The radioactivity produced in copper and carbon strips by irradiation with 66-Mev bremmstrahlung is used to determine the angular spread of the x-ray beam. The beam breadth at half maximum intensity indicated an angular spread of 2.03 ± 0.03 degrees with copper, and a spread of 2.08 ± 0.04 degrees with carbon detectors. These results are approximately 8% smaller than predicted by Schiff's theory for a target of tungsten, 5 mils thick. (auth)

2181 UCRL-3212

California. Univ., Berkeley. Radiation Lab.
BEVATRON OPERATION AND DEVELOPMENT. VI. [Period Covered]: May, June, July 1955. Harry G. Heard. Nov. 18, 1955. 28p. Contract W-7405-eng-48.

Changes and improvements in Bevatron auxiliaries, experimental facilities, and equipment are reported. Development work included experiments on increasing the acceptance time of the Bevatron, self-tracking of the radiofrequency equipment, and the substitution of an analog computer for the 30-point curve corrector. Results of a preliminary survey of fast-neutron flux in the Bevatron building are presented. The research program utilizing the Bevatron is outlined. (For preceding period see UCRL-3033.) (M.P.G.)

2182

BREMSSTRAHLUNG SPECTRUM FROM THE INTERNAL TARGET OF A 22-MEV BETATRON. E. V. Weinstock and J. Halpern (Univ. of Pennsylvania, Philadelphia). Phys. Rev. 100, 1293-8(1955) Dec. 1.

The intensity and energy distribution of the bremsstrahlung photons produced in a betatron operating at 22 Mev have been determined by measurement of the energy spectrum of photoprotons ejected from deuterium. The protons were detected using a 0.15 cm thick NaI crystal followed by a 100-channel pulse-height analyzer. The photon beam was highly collimated in the forward direction. If one assumes the energy dependence of the cross section for the photodisintegration of deuterium as given by Hulthén, the computed bremsstrahlung energy distribution is in excellent agreement with the theoretical thin-target spectrum. The observed total intensity is that indicated by monitoring using an "R" thimble imbedded in 3.9 cm of Lucite. (auth)

2183

THIRD-ORDER ABERRATION AND FOCUSING WITH SECTOR-SHAPED MAGNETIC FIELDS. Daniel F. Dempsey (Univ. of Notre Dame, Ind.). Rev. Sci. Instr. 26, 1141-5 (1955) Dec.

A divergent beam of monoenergetic charged particles can be refocused by a homogeneous magnetic field whose sharply defined boundaries are straight lines or circles. The transverse aberration of order α^3 at the image point is evaluated and a general third-order focusing condition is given. Design equations for third-order instruments are obtained and the results presented graphically. Many third-order focusing designs follow, both symmetrical and asymmetrical. (auth)

2184

GAS SCATTERING IN A STRONG FOCUSING ELECTRON SYNCHROTRON. Michael J. Moravcsik and J. Michael Sellen, Jr. (Cornell Univ., Ithaca, N. Y.). Rev. Sci. Instr. 26, 1158-64(1955) Dec.

Scattering of the electron beam by the residual gas in the vacuum chamber is calculated for the 1-Bev strong-focusing Cornell Mesotron. It is shown that the elastic scattering by the nucleus and the inelastic scattering by the atomic electrons are the only important contributions to the loss due to the presence of gas. These two effects are calculated in detail. Radiation and space charge effects are not discussed. Because of the small scattering angles involved the details of the screening by the atomic electrons must be taken into account accurately. Multiple scattering is shown to be of little importance because of the damping of the beam oscillations as the energy increases. The calculations are carried out for two different injection conditions and little difference is found between them as far as the loss due to the scattering itself is concerned. The numerical results for the Cornell Mesotron show that about half of the beam gets lost at a vacuum of 5×10^{-6} mm Hg. The scattering losses will depend on the field lattice of the synchrotron. (auth)

2185

HIGH-CURRENT ACCELERATORS. Ernest O. Lawrence (Univ. of California, Berkeley). Science 122, 1127-32(1955) Dec. 9.

A general discussion of accelerators is presented with special attention to the development of the cloverleaf cyclotron and a linear accelerator of the cavity-resonator type. (M.P.G.)

2186

NON-LINEAR REGENERATIVE EXTRACTION OF SYNCHROCYCLOTRON BEAMS. K. J. Le Couteur (Liverpool Univ., England) and S. Lipton (Rothamsted Experimental Station, England). Phil. Mag. (7) 46, 1265-80 (1955) Dec.

To extract a beam of a maximum energy from a synchrocyclotron, the deflector must be placed at the edge of the magnet, where the magnetic field falls off very rapidly and non-linearly with radius. This presents an analytical problem of coupled non-linear differential equations with periodic coefficients which is solved approximately. The results have been checked by electronic computation. It is concluded that a non-linear deflector can extract the beam with higher energy and perhaps greater theoretical efficiency than the linear one at present working at Liverpool. The new method is mechanically simpler than the old for it has no peeler, only a regenerator. The mathematics has interest apart from this application, for the difficulty of handling these coupled cyclotron equations is a major obstacle to the development of new particle accelerators of the fixed field type. (auth)

RADIATION ABSORPTION AND SCATTERING

2187 AERE-RS-L-3

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE THEORY AND PRACTICE OF SHILEDING. C. C. Horton. Nov. 25, 1954. 19p.

The processes by which neutrons and γ rays lose energy in shields are discussed, and methods of calculating the energy loss are summarized. The methods are applied to reactor shielding. Specific examples and problems are included. (M.P.G.)

2188

PHASE ANALYSIS OF PROTON SCATTERING BY PROTONS. A. Zimin. Doklady Akad. Nauk S.S.S.R. 105, 73-6(1955) Nov. 1. (In Russian)

An attempt is made to evaluate the S and P phases as the more essential ones in the scattering of protons by protons in the energy range from 450 to 500 Mev. (R.V.J.)

2189

QUANTUM KENETIC EQUATION FOR MULTIPLE SCATTERING. A. Migdal. Doklady Akad. Nauk S.S.S.R. 105, 77-9(1955) Nov. 1. (In Russian)

The integral equation for the electron density matrix, averaged on the distribution of the scattering atoms was calculated. This integral equation is the quantum analogy of the classical kinetic equation. With higher energy electrons, the integral equation is reduced to a differential form. (R.V.J.)

2190

PRODUCTION OF Y^{89m}, Ba^{137m}, AND Hg^{199m} BY INELASTIC NEUTRON SCATTERING. C. P. Swann and F. R. Metzger (Bartol Research Foundation of the Franklin Inst., Swarthmore, Penna.). Phys. Rev. 100, 1329-33(1955) Dec. 1.

Isomeric states in Y^{89} (913 kev), Ba^{137} (661 kev), and Hg^{199} (527 kev) have been excited by inelastic scattering of monoenergetic neutrons. The shape of the excitation curves agrees rather well with the prediction of the strong interaction theory, but the theoretical cross sections are, at least in the cases with simple decay schemes, considerably larger than the experimental ones. (auth)

2191

PROTON-PROTON POLARIZATION AT 170 MEV. David Fischer and John Baldwin (Univ. of California Radiation Lab., Berkeley). Phys. Rev. 100, 1445-7(1955) Dec. 1.

The proton-proton polarization has been measured at 170 Mev. The data have been fit to a curve of the form $P = \sin\theta\cos\theta(\alpha + \beta\cos^2\theta)$, yielding $\alpha = 0.31 \pm 0.09$ and $\beta + 0.30 \pm 0.14$. A comparison is made with results obtained at other energies. (auth)

2192

THE NUCLEAR SCATTERING OF ELECTRONS AND POSITRONS AT 10 MEV. W. Bosley and I. S. Hughes (Univ. of Glasgow, Scotland). Phil. Mag. (7) 46, 1281-6 (1955) Dec.

Measurements have been made on the single (large angle) and multiple coulomb scattering of electrons and positrons in nuclear emulsions. The results obtained for single scattering are in general agreement with the theoretical expectations and appear to confirm the prediction of a difference between the nuclear scattering of electrons and positrons at 10 Mev, although the data are insufficient to permit detailed comparison. The results for the multiple scattering show an unexplained difference between the two types of particle. The number of positrons observed to annihilate in flight is in agreement with the theoretical predictions of Dirac (1930). (auth)

Refer also to abstracts 2117, 2134, 2140, 2151, 2152, 2157, 2182, 2230, and 2232.

RADIATION EFFECTS

2193 MIT-1091

Massachusetts Inst. of Tech., Cambridge.

RADIATION DAMAGE IN 99.0% ALUMINUM. J. L. Klein and W. B. Nowak. [1952?]. Decl. Oct. 6, 1955. 14p. Contract AT(30-1)-981.

Measures of the internal distortions in cold worked and irradiated 2S aluminum have been made by means of a Fourier analysis of x-ray line shapes. The (220) and the (311) reflections were recorded on a Norelco High-Angle Spectrometer. Changes in the resolution of the Kα doublet indicated that a fast neutron irradiation of about 4×10^{20} n/cm^2 produced further distortions in previously cold worked 2S aluminum. The Fourier coefficients yield quantitative values for the rms distortions produced by cold work and by cold work plus irradiation. Residual rms strains attributable to irradiation are of the same order of magnitude (0.1%) as those caused by cold work. (auth)

2194 WAPD-77

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

CORRELATION OF ZIRCONIUM ELECTRICAL RESISTIVITY WITH FAST FLUX. M. L. Bleiberg, R. L. Ely, Jr., and W. F. Witzig. May 20, 1953. Decl. Nov. 2, 1955. 23p. Contract AT-11-[1]-GEN-14.

The integrated fast flux distribution in the L-41 hole of the Materials Testing Reactor was determined for neutrons with energies between 2 and 7 Mev by using a fast flux monitor, $S^{32}(n,p)P^{32}$. These values of integrated fast-flux were correlated with changes in electrical resistivity of crystal bar Zr and a 2.5% Sn–crystal bar Zr alloy. (auth)

RADIOACTIVITY

2195 MLM-896

Mound Lab., Miamisburg, Ohio.

GAMMA RAY SPECTRUM AND INTENSITY OF POLONIUM 208-209. (Information Report). George L. Fox. Sept. 16, 1953. Decl. Sept. 30, 1955. 13p. Contract AT-33-1-GEN-53.

Gamma radiation of $Po^{208-209}$ produced by proton irradiation of Bi^{209} was investigated. Gamma energies of 0.89, 0.58, 0.27, and 0.07 Mev were identified by means of a scintillation spectrometer. Gamma-to-alpha intensity ratios of 10.3×10^{-5} and 8.56×10^{-5} were determined for Po prepared by irradiation with 19 and 23-Mev protons, respectively. The half life of this gamma radiation was 7.8 ± 0.75 yr. This value deviates from the reported half life of 100 hr for Po^{209}. (auth)

2196

K-CAPTURE IN THE DECAY OF CHLORINE-36. R. W. P. Drever and A. Moljk (Univ. of Glasgow, Scotland). Phil. Mag. (7) 46, 1337-42(1955) Dec.

A search for the existence of K capture in Cl^{36} has been made using a proportional tube spectrometer with labelled methyl chloride as a gaseous source. A peak which was observed in the β spectrum corresponded to the K radiation of sulphur and indicated the presence of K capture. The branching ratio K/β^- was found to be (1.7 ± 0.1)%. A scintillation spectrometer failed to detect any γ ray lines above 20 kev with intensity greater than 10^{-4} of the β intensity, so the observed K-capture transition goes to the ground state of S^{36}. (auth)

2197

THE γ-RAY SPECTRUM OF FISSION PRODUCTS FROM SLOW NEUTRON IRRADIATION OF URANIUM-235. D. H. Peirson (Atomic Energy Research Establishment, Harwell, Berks, England). Brit. J. Appl. Phys. 6, 444-9(1955) Dec.

The fission products from U^{235}, irradiated by slow neutrons, have been analyzed by a two-crystal γ-ray scintillation spectrometer. The spectrum between 1 day and 70 days after irradiation has been recorded. The gross spectrum varies with time and consists of 2 groups of lines around 0.2 and 0.7 Mev, with a single line at 1.58 Mev as the only important component above 1 Mev. By measurement of energy and decay rates, 17 activities due to fission products of high yield are identified during the period of analysis. The spectrometer is described and its use as an analytical tool in other applications indicated. (auth)

2198

C^{14} DATING WITH A METHANE PROPORTIONAL COUNTER. W. H. Burke, Jr. and W. G. Meinschein (Magnolia Petroleum Co., Dallas, Tex.). Rev. Sci. Instr. 26, 1137-40(1955) Dec.

Apparatus and procedures for conversion of sample carbon to carbon dioxide, quantitative hydrogenation of carbon dioxide to methane, and radiocarbon assay of the methane are described. Two sizes of counters are used. At the operating pressure of two atmospheres, the larger size contains 0.85 g of carbon and the smaller 0.22 g. If the sample and background are both counted for 24 hours in a 0.85-g counter, a sample 34,000 years old (26,000 years old in the 0.22-g counter) gives a C^{14} count equal to twice its standard statistical error. If desired, this method can readily be adapted to larger samples with a consequent increase in the maximum measurable age. (auth)

2199

RADIOACTIVE Ca^{47}. W. S. Lyon and T. H. Handley (Oak Ridge National Lab., Tenn.). Phys. Rev. 100, 1280-3(1955). Dec. 1.

Ca^{47} (4.5 day) has been investigated by using β-γ coincidence measurements and NaI gamma-ray spectrometry. Three γ rays of energies 1.29 Mev, 0.812 Mev, and 0.500 Mev are present with absolute intensities of (71 ± 6)%, (5 ± 0.5)%, and (5 ± 0.5)%, respectively. These gammas are in coincidence with a 0.70 ± 0.02 Mev β group. In addition, (24 ± 6)% of the decay is through a 1.9 ± 0.2 Mev β group directly to the ground state. (auth)

2200

RADIOACTIVITY OF Sc^{44}. J. W. Blue and E. Bleuler (Purdue Univ., Lafayette, Ind.). Phys. Rev. 100, 1324-9(1955) Dec. 1.

The decay of Sc^{44} has been reinvestigated using a NaI gamma-ray spectrometer and a magnetic-lens spectrometer adapted to coincidence measurements. The main transition from the Sc^{44} ground state is to the first excited level of Ca^{44} at 1.159 ± 0.003 Mev. The probability for positron emission is 0.932 ± 0.015, in agreement with the theoretical value of 0.928 for an allowed transition (E_{max} = 1.471 ± 0.005 Mev). The conversion coefficients of the 1.16-Mev gamma ray and of the isomeric transition in Sc^{44} are $6.3 \pm 0.3 \times 10^{-5}$ and 0.139 ± 0.003, compatible with E2 and EA transitions, respectively. A weak allowed decay leads to a level in Ca^{44} at 2.54 ± 0.03 Mev. The continuous spectrum of low-energy electrons previously reported by J. A. Bruner was found to depend strongly on the thickness of the source and the backing. For the thinnest sources the

intensity was found to be ⅓ of that previously reported. Coincidence measurements showed that more than ⅔ of the electrons are not coincident with both the positrons and the gamma rays and are, therefore, not emitted in the process of positron decay. It is concluded that there is no indication for a disagreement between the experiment and the theory of atomic excitation during beta decay. (auth)

2201

RADIOCHEMICAL STUDY OF Tl^{195}, Tl^{197}, AND Tl^{198m}. J. D. Knight and E. W. Baker (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 100, 1334-8(1955) Dec. 1.

A new neutron-deficient nuclide, Tl^{195}, has been produced by 20-Mev deuteron bombardment of Hg^{196}, and its identity and its half-life (1.2 ± 0.1 hours) have been established by timed chemical separations of the Hg^{195} daughter. The assignment and half-life (2.8 ± 0.2 hours) of Tl^{197} have been confirmed by timed chemical separations of its Hg^{197} daughter. The radiations of Tl^{197} and Tl^{198m} have been examined with a gamma scintillation spectrograph and a 180° beta-ray spectrograph. The presence of a number of new gamma rays associated with Tl^{198m} reveals an electron capture branch in the decay of this isomer; the data indicate a ratio of electron captures to isomeric transitions between 1 and 2. (auth)

2202

RADIOACTIVE DECAY OF THE ISOMERS OF AMERICIUM-242. R. W. Hoff, H. Jaffe, T. O. Passell, F. S. Stephens, E. K. Hulet, and S. G. Thompson (Univ. of California Radiation Lab., Berkeley). Phys. Rev. 100, 1403-6(1955) Dec. 1.

The decay characteristics of the two isomers of Am^{242} have been investigated. The β decay of the 16-hour Am^{242m} has a branching ratio of 51 ± 5% to the first-excited state (42.3 kev) of Cm^{242} with the remainder of the decay going to the ground state. The electron-capture decay of Am^{242m} has a branching ratio of approximately 60% to the first-excited state (44.8 kev) of Pu^{242}. An upper limit of 6% has been set for the fraction of Am^{242m} decay via isomeric transition. The β decay of the 100-year Am^{242} has a branching ratio of 45 ± 5% to the first-excited state of Cm^{242}, with the remainder of the decay going to the ground state. The β-spectrum end points for Am^{242m} and Am^{242} have been measured to be 620 ± 10 kev and 585 ± 10 kev, respectively. A decay scheme for the two isomers has been proposed. Log ft values have been calculated for β and electron-capture decay of the isomers and are discussed in conjunction with spin and parity assignments. (auth)

2203

DECAY OF Ir^{192}. L. L. Baggerly, P. Marmier, F. Boehm, and J. W. M. DuMond (California Inst. of Tech, Pasadena). Phys. Rev. 100, 1364-7(1955) Dec. 1.

A study has been made of the γ radiation following the decay of Ir^{192}. The energies, intensities, internal conversion coefficients and multipolarities of the gamma transitions have been determined. Energy level schemes for the daughter nuclei, Pt^{192} and Os^{192}, are proposed. The spins and parities of most of the levels are given. (auth)

2204

DECAY SCHEME OF In^{107}. Wayne A. Cassatt, Jr. and W. Wayne Meinke (Univ. of Michigan, Ann Arbor). Phys. Rev. 100, 1372-3(1955) Dec. 1.

The γ radiations of In^{107} have been investigated with a scintillation spectrometer. The In^{107} was produced in a cyclotron by a (d,n) reaction on electromagnetically enriched Cd^{106}. Beta-gamma and γ-γ coincidence experiments showed, in addition to the annihilation radiation, only one γ ray of 0.22-Mev associated with the 2-Mev positron. (auth)

2205

NEW GAMMA RAYS IN THE NEPTUNIUM-239 DECAY. Harlan W. Lefevre, Edwin M. Kinderman, and Harold H. Van Tuyl (Hanford Atomic Products Operation, Richland, Wash.). Phys. Rev. 100, 1374(1955) Dec. 1.

Two unreported γ rays of energy 0.44 and 0.49 Mev are assigned to Np^{239} by reason of chemical properties and decay constant. The intensities of these γ rays relative to a previously reported Np^{239} gamma at 0.334 Mev have been determined to be γ_1(0.33 Mev) : γ_2(0.44 Mev) : γ_3(0.49 Mev) = 100 : 0.40 : 0.50. Measured yields (γ rays per decay) for the 0.44- and 0.49-Mev gammas are 1.6×10^{-4} and 1.9×10^{-4} γ rays per decay. It seems probable that both of these γ rays originate from a single Pu^{239} level at 0.49 Mev. (auth)

2206

RADIOACTIVE DECAYS OF Rh^{106} AND Ag^{106}. D. E. Alburger and B. J. Toppel (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 100, 1357-63(1955) Dec. 1.

Transitions in Pd^{106} occurring in the decays of Rh^{106} and Ag^{106} have been examined with a three-crystal pair spectrometer using gray-wedge pulse-height analysis, single and coincidence scintillation spectrometer techniques and an intermediate-image β spectrometer. In addition to lines previously known, γ rays of 1.77, 1.96, 2.10, and 2.66 Mev and a possible γ ray of 1.14 Mev are found in Rh^{106} decay. Gamma rays of energies 0.22, 0.409, 0.51, 0.62, 0.72, 0.805, 1.045, 1.131, 1.205, 1.23, 1.39, 1.55, 1.77, 1.85, 2.1, and 2.63 Mev are observed in Ag^{106} decay. Most of the data can be satisfied by postulating in addition to the five previously known states in Pd^{106} three new weakly excited levels at 1.85, 2.27, and 2.66 Mev. A lower limit of $\sim 10^{-8}$ sec is estimated for the partial half-life of the 0-0 transition between the second excited and ground states of Pd^{106}. (auth)

2207

DECAY SCHEME OF Sc^{47}. R. T. Nichols and E. N. Jensen (Iowa State Coll., Ames). Phys. Rev. 100, 1407-9(1955) Dec. 1.

The radiations of Sc^{47} have been examined with a scintillation spectrometer and with an intermediate image spectrometer operated in conjunction with a scintillation spectrometer for coincidence spectra. Two beta groups were observed with maximum energy values of 0.596 ± 0.010 and 0.430 ± 0.005 Mev and relative intensities of 36% and 64%, respectively. The log ft values of the beta groups were found to be 6.0 and 5.3, respectively. One γ ray was observed having an energy of 0.167 ± 0.002 Mev. The coincidence β spectrum contained only the lower energy group. The decay scheme for Sc^{47} is discussed. (auth)

2208

ALPHA-DECAY PROPERTIES OF Am^{239}. Frank Asaro, F. S. Stephens, Jr., W. M. Gibson, R. A. Glass, and I. Perlman (Univ. of California, Berkeley). Phys. Rev. 100, 1541-2 (1955) Dec. 1.

A study was made of the Am^{239} decay in order to determine whether the favored alpha transition led to a state of Np^{235} which was de-excited by an E1 transition. The sample was prepared by deuteron irradiation of Pu^{239}, and a ZnS

screen was used for the α detector. The α–γ coincidence spectrum and the Am^{239} decay scheme are shown. Results show that almost every α disintegration of Am^{239} goes through a 48-kev state to Np^{235}, and the transition is identified as E1. (B.J.H.)

2209

RADIATIONS FROM 1− STATES IN EVEN-EVEN NUCLEI. F. S. Stephens, Jr., Frank Asaro, and I. Perlman (Univ. of California, Berkeley). Phys. Rev. 100, 1543-5(1955) Dec. Dec. 1.

The gamma ray spectrum of Th^{230} was taken with a NaI scintillation spectrometer. The decay scheme is shown, giving a 1− state at 253 kev. This decay is typical of those from even-even nuclei. (B.J.H.)

2210

THE NEW ISOTOPES Pu^{246} AND Am^{246}. D. Engelkemeir, P. R. Fields, S. Fried, G. L. Pyle, and C. M. Stevens (Argonne National Lab., Lemont, Ill.) and L. B. Asprey, C. I. Browne, H. Louise Smith, and R. W. Spence (Los Alamos Scientific Lab., N. Mex.). J. Inorg. and Nuclear Chem. 1, 345-51(1955) Dec.

The half lives of Pu^{246} and Am^{246} were estimated to be 11.2 ± 0.2 days and 25 ± 0.2 min, respectively. The total disintegration energy of Am^{246} was determined to be 2.29 Mev. (C.W.H.)

Refer also to abstracts 2042 and 2154.

SPECTROSCOPY

2211

VACUUM INTERFEROMETER AND CADMIUM OVEN. Kenneth B. Adams (Westinghouse Research Labs., East Pittsburgh) and Keivin Burns (Allegheny Observatory, Pittsburgh). J. Opt. Soc. Amer. 46, 36-8(1956) Jan.

Temperature and pressure changes during observation by means of a Fabry-Perot interferometer are discussed. A temperature regulated vacuum chamber has been designed to minimize the effects of these changes. Details of a simple and efficient interferometer and housing are given. A convenient and satisfactory oven for holding a Michelson lamp at any desired temperature between that of the room to the standard 315°C is described in detail. The vacuum interferometer, the lamp house, and the assembly used to compare the spectra of Hg^{198} and Cd^{114} are shown by diagram and drawing. (auth)

2212

FABRY-PEROT INTERFEROMETER WITH FINITE APERTURES. K. L. Vander Sluis and J. R. McNally, Jr. (Oak Ridge National Lab., Tenn.). J. Opt. Soc. Amer. 46, 39-46(1956) Jan.

Closed mathematical expressions are developed for the Fabry–Perot interferometer with finite apertures for both noncoherent and coherent illumination. For most practical cases these expressions are substantially equivalent but reveal more serious aperture effects than the approximate theoretical treatment of Geiger. The effects expected are of particular importance in problems involving either compound interferometers or high reflection coatings. However, even at low reflectivities significant reductions in peak intensity and resolution are to be expected. The conditions for obtaining a 99% efficient interferometer are expressed in terms of the reflectivity and aperture parameters. These expressions, still limited by the assumptions of smooth, plane parallel films, suggest modifications to the usual applications of the interferometer. (auth)

2213

SPECTROSCOPY OF GASEOUS CARBONYLS. I. INFRARED SPECTRA AND THERMODYNAMIC PROPERTIES OF CHROMIUM AND MOLYBDENUM HEXACARBONYLS. N. J. Hawkins, H. C. Mattraw, W. W. Sabol, and D. R. Carpenter (Knolls Atomic Power Lab., Schenectady, N. Y.). J. Chem. Phys. 23, 2422-7(1955) Dec.

Infrared spectra of gaseous Cr and Mo hexacarbonyls were obtained. The spectra could be interpreted as resulting from an $X(YZ)_6$-type molecule of O_h-symmetry. Of the thirteen fundamental vibration frequencies possible, all but three are fairly well established. The fundamentals are shown to be of two distinct types: those which are typical of a heavy outer atom octahedral molecule and those which are typical of the carbon and oxygen moving in opposition to each other. Thermodynamic properties are computed for the ideal gases for various temperatures to 600°K. (auth)

2214

SHORT-LIVED SPECIES FROM THE PHOTOLYSIS OF AQUEOUS ALKALI HALIDE AND HALOGEN SOLUTIONS. L. I. Grossweiner and M. S. Matheson (Argonne National Lab., Lemont, Ill.). J. Chem. Phys. 23, 2443-4(1955) Dec.

Absorption spectra of short-lived species resulting from irradiation of He-saturated solutions of halogens in H_2O and of alkali halides in H_2O are reported. A dihalide ion is suggested as a photolysis product of aqueous halides. (C.W.H.)

2215

INFRARED SPECTRUM OF $Ni(CO)_4$ VAPOR. Llewellyn H. Jones (Los Alamos Scientific Lab., N. Mex.). J. Chem. Phys. 23, 2448(1955) Dec.

Infrared spectra of nickel carbonyl were observed from 270 to 10,000 cm^{-1}. No absorption was observed from 270 to 400 cm^{-1}. A strong band appeared at 422 ± 1 cm^{-1} and was assigned to the asymmetric Ni−C stretching vibration (F_2 symmetry). A new band was also observed at 459 cm^{-1} Close correlations with previously reported spectral data were observed in the high-frequency region. (C.W.H.)

2216

INFRARED SPECTRUM OF LiH. William Klemperer (Harvard Univ., Cambridge, Mass.). J. Chem. Phys. 23, 2452(1955) Dec.

The infrared spectrum of LiH has been observed in emission in the frequency region 1500 to 970 cm^{-1}. Lines in the P-branch of the $0 \rightarrow 1$ vibrational transition from $J = 0$ to $J = 21$ and those in the R-branch from $J = 1$ to $J = 12$ were resolved. Seventeen lines of the $1 \rightarrow 2$ transition were resolved. Using the harmonic oscillator rigid rotor approximation, $D^0_{LiH} \geq 56$ kcal/mol is obtained. (auth)

2217

PARAMAGNETIC RESONANCE IN X-IRRADIATED PLASTICS AND IN PLASTIC SOLUTIONS OF FREE RADICALS. E. E. Schneider (Univ. of Durham, Newcastle-upon-Tyne, England). Discussions Faraday Soc., No. 19, 158-65(1955).

Paramagnetic resonance, occurring as a result of x-irradiation (10^5 to 10^7 r) in plastics such as polymethyl methacrylate, polystyrene, polyethylene, and polytetra-

fluoroethylene, has been investigated at 3 cm wavelength. A dominant triplet structure of resonance lines is observed in all cases, consisting of a strong central line and two symmetrical satellites. In irradiated polymethyl methacrylate, where the resonance for a given x-ray dosage is very much stronger than in other plastics, this triplet structure is well resolved and superimposed on a very symmetrical pattern of at least another six lines. It is suggested that the unpaired electrons responsible for the resonance are created as a final result of the x-irradiation by a breaking of C–C bonds in the polymer chain and are essentially localized in p-orbitals on C atoms. On this basis the complex structure of the spectra is explained as a hyperfine splitting arising from the interaction of the localized p-electron with protons or fluorine nuclei in its immediate neighborhood. Resonance experiments on DPPH are reported, in which plastics are used as solid solvents. The results are shown to lend indirect support to the ideas of localization of electrons on the plastic polymer chains. (auth)

2218

PARAMAGNETIC RESONANCE STUDIES OF ATOMIC HYDROGEN PRODUCED BY IONIZING RADIATION. Ralph Livingston, Henry Zeldes, and Ellison H. Taylor (Oak Ridge National Lab., Tenn.). Discussions Faraday Soc., No. 19, 166-73(1955).

Free radicals produced in various substances by Co^{60} gamma rays have been observed by the paramagnetic resonance method. One pair of lines observed in irradiated H_2SO_4, $HClO_4$ and H_3PO_4 has been identified as arising from atomic hydrogen as shown by deuterium substitution experiments and a consideration of the strength of the hyperfine interaction. Atomic hydrogen is also formed from water adsorbed on glass surfaces. Atomic hydrogen was not found in irradiated ice. The presence of additional, weak paramagnetic resonance lines gives information on the environment of the atomic hydrogen, while warming experiments give rate data that indicate second order kinetics for the disappearance of atomic hydrogen. (auth)

2219

NUCLEAR MAGNETIC RESONANCE SPECTRUM AND MOLECULAR STRUCTURE OF ALUMINIUM BOROHYDRIDE. Richard A. Ogg, Jr. and James D. Ray (Stanford Univ., Calif.). Discussions Faraday Soc., No. 19, 239-46(1955).

High resolution H^1 and B^{11} magnetic resonance spectra are presented for liquid AlB_3H_{12} and highly deuterium-substituted derivatives. In the case of H^1 spectra the technique of double resonance is also employed, with saturation of either the B^{11} or Al^{27} resonance. It has been found, using such spectra for identification, that at moderate temperatures AlB_3H_{12} undergoes reversible dissociation into B_2H_6 and a hitherto unrecognized compound, described as $Al_2B_4H_{18}$. The equilibrium is characterized by an extraordinarily large standard entropy change. The nuclear magnetic resonance spectra of the new substance have also been studied. It is concluded that AlB_3H_{12} is characterized by a bridge bond structure, analogous to that of B_2H_6, but that a dynamic process renders bridge and terminal protons indistinguishable. Evidence is offered in support of the view that a quantum-mechanical tunnel effect is involved. The structure assigned to $Al_2B_4H_{18}$ has similar features, but it is concluded that proton tunnelling and actual rotation of borohydride groups are in operation. (auth)

2220

A NUCLEAR RESONANCE INVESTIGATION OF POLYTETRAFLUOROETHYLENE. J. A. S. Smith (Univ. of Leeds, England). Discussions Faraday Soc., No. 19, 207-15(1955).

The nuclear resonance spectra of various samples of oriented and unoriented polytetrafluoroethylene have been examined in the temperature range 77 to 334°K. The changes in line shape and second moment of the absorption curve are discussed in terms of the structure of the polymer and the transitions previously observed by other methods. (auth)

2221

HIGH RESOLUTION OF PROTON MAGNETIC RESONANCE SPECTRA. W. A. Anderson and J. T. Arnold (Stanford Univ., Calif.). Discussions Faraday Soc., No. 19, 226-9 (1955).

Equations for the calculation of proton energies and spectra are presented. The difference in observed line widths and the hydroxyl proton exchange in ethyl alcohol are discussed. (C.W.H.)

2222

PROTON MAGNETIC RESONANCE SPECTRA OF CRYSTALLINE BOROHYDRIDES OF SODIUM, POTASSIUM AND RUBIDIUM. P. T. Ford and R. E. Richards (Physical Chemistry Lab., Oxford, England). Discussions Faraday Soc., No. 19, 230-8(1955).

Proton resonance spectra have been recorded for crystalline samples of Na, K, and Rb borohydrides at temperatures in the range 20 to 293°K. The second moments of the resonance spectra are used to deduce a value for the B–H distance in the BH_4^- ion. Evidence is presented in favor of values in the range 250 to 500 cm^{-1} for the torsional oscillation frequency of the BH_4^- ion in the crystal lattice. Assuming this to be correct, the B–H distance is found to be 1.255 ± 0.02 A. The variation of second moment with temperature in the region of the line width transitions has been measured, and shown to be consistent with potential barriers to reorientation of the BH_4^- ion of 2.4, 3.8, and 3.9 kcal/mol for the Na, K, and Rb salts. (auth)

2223

NUCLEAR MAGNETIC RESONANCE IN AMMONIUM FLUORIDE. L. E. Drain (Univ. Coll., London). Discussions Faraday Soc., No. 19, 200-7(1955).

The line widths of the proton and fluorine magnetic resonances in powdered ammonium fluoride have been measured at temperatures between 140 and 360°K. Line-width transitions were found in both resonances at about 280°K. From the second moments of the low temperature absorption lines, the N–H distance in the ammonium ion was determined to be 1.04 ± 0.01 A and the H–F distance in the crystal, 1.64 ± 0.02 A. The widths of the resonances at high temperatures were consistent with the supposition of a hindered rotation of the ammonium ion. From the dependence of mean square line-width on temperature, the barrier to this rotation was estimated to be about 10,000 cal/mol. (auth)

2224

THE MEASUREMENT OF SPECIMEN TEMPERATURE IN A HIGH TEMPERATURE X-RAY POWDER CAMERA. R. S. Pease (Atomic Energy Research Establishment, Harwell, Berks, England). J. Sci. Instr. 32, 476-80(1955) Dec.

Errors of specimen temperature measurement by means of thermocouples placed near the specimen are examined theoretically and experimentally for the case of an evacuated Unicam camera, where the furnace arrangements can be regarded as an imperfect radiation bath. Errors which increase monotonically with temperature arise because the radiation temperature of the furnace is not everywhere the same. Errors which are of opposite sign, and which increase to a maximum at about 200°C and then decrease with increasing temperature, arise because of conduction down the thermocouple leads. Design requirements to minimize the errors and keep them constant from one specimen to another are given. (auth)

2225

REACTIONS WITH N^{15}. XVIII. IMPROVED SPECTROSCOPIC MICROMETHODS FOR THE ANALYSIS OF N^{15}. H. Hurzeler and H. U. Hostettler. Helv. Chim. Acta 38, 1825-31(1955) Nov. (In German)

An improved method for band spectrographic analysis of isotopes is described. It is substantially independent of the flaws of the photographic plates. The method required only 20 N_2 γ's and will have less contamination faults than mass spectrographic methods. The mean relative error is ±2%. (tr-auth)

THEORETICAL PHYSICS

2226 AECU-3122

RAND Corp., Santa Monica, Calif.

THE EQUATION OF STATE OF WATER ON THE THOMAS-FERMI MODEL. A. Latter and R. Latter. Oct. 24, 1955. 30p. For Univ. of Calif. Radiation Lab. [Contract W-7405-eng-48], Subcontract SC-64. (RM-1574-AEC).

Two methods are described for extending the Thomas-Fermi model of a compressed atom to molecules or mixtures of the type Z Z_N'. The methods are applied to H_2O at zero temperature to determine pressure and internal energy as functions of the density, the position of the protons relative to the oxygen nucleus, and the electrostatic potential distribution within the molecule. (auth)

2227 AERE-Lib/Trans.-585

ON THE KINETICS OF THE ISOTHERMAL MARTENSITE TRANSFORMATION CLOSE TO ABSOLUTE ZERO. B. Ya. Lyubov and Yu. A. Oxipyan. Sept. 1955. 6p. Translated by Dr. J. B. Sykes from Doklady Akad. Nauk. S.S.S.R. 101, 853-6(1955).

A quantum mechanical study has been made on the martensite transformation near absolute zero in order to determine the nature of the factors affecting the transformation properties. Results show that the rate of martensite transformation does not depend on the temperature at temperatures close to absolute zero. Thus the vibrational energy of the atoms is the chief factor which determines the rate of the transformation. (B.J.H.)

2228

EFFECT ON X-RAY FINE STRUCTURE OF DEVIATIONS FROM A COULOMB FIELD NEAR THE NUCLEUS. A. L. Schawlow and C. H. Townes (Columbia Univ., New York). Phys. Rev. 100, 1273-80(1955) Dec. 1.

Deviations from a Coulomb field near the nucleus of very heavy atoms appear to produce changes as large as about one part in 400 on the fine structure splitting of the 2p electronic level. Theoretical evaluation of these changes is discussed and available x-ray data analyzed to yield an experimental determination of their magnitude. A nuclear radius as large as 2×10^{-13} $A^{1/3}$ cm must be assumed if the observed effects come only from deviations in the Coulomb field due to the finite nuclear size. The preferred interpretation is that most of the contribution to the observed change in fine structure comes from quantum electrodynamic effects (Lamb shift) which produce deviations from a Coulomb field near the nucleus. This appears to provide a method for study of the Lamb shift for large Z and possibly also of nuclear size. (auth)

2229

ANOMALOUS MAGNETIC MOMENT OF THE NUCLEON. Kurt Haller (Newark Coll. of Engineering, N. J. and Columbia Univ., New York) and Marvin H. Friedman (Columbia Univ., New York). Phys. Rev. 100, 1501-2 (1955) Dec. 1.

The ground-state solution of the physical nucleon problem in the Tomonaga approximation is used to compute the anomalous magnetic moment of nucleons. When computed on the basis of parameters that make the phase shift calculations in the Tomonaga approximation consistent with meson-nucleon scattering data, the values obtained are +1.48 for the proton and −1.48 for the neutron. (auth)

2230

DISPERSION RELATIONS FOR PION-NUCLEON SCATTERING. I. THE SPIN-FLIP AMPLITUDE. Reinhard Oehme (Institute for Nuclear Studies, Chicago). Phys. Rev. 100, 1503-12(1955) Dec. 1.

Dispersion relations are derived for the derivative with respect to sin ϑ, taken at zero angle, of the spin-flip amplitude for pion-nucleon scattering. The derivation of these relations is based on general field-theoretical concepts. It is shown that the condition of microscopic causality is sufficient and essentially also necessary for the existence of these equations. The special form of the dispersion relations depends on the assumptions about the high-frequency behavior of the spin-flip amplitude. The exact dispersion formulas, which are derived under the more stringent boundedness condition for the amplitude, can be reduced to the spin-flip part of Low's equations for P-wave scattering. This reduction involves approximations which correspond to those underlying the direct derivation of Low's equations. Under certain conditions, the dispersion relations may hold approximately at low energies even if the causality condition is not valid in small but finite regions. This possibility is discussed briefly. (auth)

2231

HAMILTONIAN FORM OF INTEGRAL SPIN WAVE EQUATIONS. K. M. Case (Univ. of California Radiation Lab., Berkeley). Phys. Rev. 100, 1513-14(1955) Dec. 1.

The Hamiltonian forms of the spin-zero and spin-one wave equations are obtained simultaneously by starting from the Duffin-Kemmer form of the equations using only algebraic properties of the β matrices. From the mode of derivation, the Hamiltonian forms for all integral-spin equations of the Dirac-Fierz-Pauli type follow immediately. (auth)

2232

PION-NUCLEON SCATTERING CALCULATIONS IN THE TAMM-DANCOFF THEORY. M. H. Kalos and R. H. Dalitz (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 100, 1515-22(1955) Dec. 1.

For the S, P, and D states (except those with $j = T = \frac{1}{2}$), phase shifts and wave functions have been calculated numerically for pion energies up to about 1 Bev, on the basis of the simplest Tamm-Dancoff integral equation for pseudoscalar pion theory both (a) including and (b) omitting the pair transitions. In the numerical treatment, special attention was paid to the various singularities of these integral equations. For the (3,3) state, a very sharp resonance is obtained for case (a) with $G^2/4\pi = 15.5$ and a good fit to the (3,3) phase shift for energies up to 300 Mev, above which the phase shift lies below the experimental value. For case (b), a coupling constant $G^2/4\pi = 30$ was needed for a fit to the low energy (3,3) phase shifts and δ_{33} then reaches resonance only at very high energies, if at all. Other phase shifts for case (a) are in general accord with those of Dyson et al. (auth)

2233

ISOBAR ROLE IN TWO-NUCLEON PROCESSES: DEUTERON PHOTOEFFECT. N. Austern (New York Univ.). Phys. Rev. 100, 1522-9(1955) Dec. 1.

An elementary model of the $\frac{3}{2}$, $\frac{3}{2}$ nucleon isobar is applied literally as an intermediate state in two-nucleon processes. The mechanism of deuteron photodisintegration which is thus implied is found to contribute most of the observed cross section at high energy. The isobar does not seem to be as important in nucleon-nucleon scattering, or in reducing the photomeson production (and similar processes) below the estimates of impulse approximation. An estimate of single-nucleon Compton effect also is given, in the context of the isobar model. (auth)

2234

THREE-BODY CONTRIBUTIONS TO THE TRITON BINDING ENERGY. Ely M. Gelbard (Univ. of Chicago). Phys. Rev. 100, 1530-8(1955) Dec. 1.

A variational calculation shows that the central part of the Lévy potential is not sufficient to bind the triton. One finds a bound S-state wave function only if the coupling constant is increased appreciably. Using wave functions determined in this way, the author has computed the binding energy contributed by five three-body terms, derived from the ps–ps theory. Results of this calculation indicate that the so-called "leading" three-body term is not the dominant term, even if damping is taken into account. The total contribution of the potentials considered here is attractive, not repulsive. (auth)

Refer also to abstract 2189.

TRITIUM AND TRITIUM COMPOUNDS

2235

VAPOR PRESSURE OF HT. Jacob Bigeleisen (Brookhaven National Lab., Upton, N. Y.). and Eugene C. Kerr (Los Alamos Scientific Lab., N. Mex.). J. Chem. Phys. 23, 2442-3(1955) Dec.

The vapor pressure of dilute solutions of HT in H_2 (mol ratio $\sim 10^{-8}$) at 20°K has been investigated. Results show that HT has a higher vapor pressure than D_2 at 20°K. (C.W.H.)

URANIUM AND URANIUM COMPOUNDS

2236 KAPL-851

Knolls Atomic Power Lab., Schenectady, N. Y.

THE TEMPERATURE-RESISTANCE CHARACTERISTICS OF URANIUM. L. L. Wyman and J. F. Bradley. Dec. 24, 1952. 33p. Contract W-31-109-Eng-52.

Temperature-resistance relationships have been established for samples of alpha-rolled uranium which have been cycled between room temperature and about 400, 520, and 1000°C, respectively. The widely varying test data show a parallelism with previous dilatation studies on these materials and reflect the effects of the anisotropy of uranium. The average physical constants derived in this work are: temperature coefficient of resistance, $\alpha \times 10^{-3}$, α phase = 2.55, β phase = 0.0847, γ phase = 0.203; specific resistance, $\sigma \times 10^{-6}$ ohm–cm = 26.292 to 32.092. (auth)

2237 MTA-41

California Research and Development Co. Livermore Research Lab., Livermore, Calif.

FORMATION CROSS SECTION OF VARIOUS U^{238} FISSION PRODUCTS AS A FUNCTION OF BOMBARDING DEUTERON ENERGY FROM 19 TO 190 MEV. H. G. Hicks, R. S. Gilbert, W. H. Hutchin, and P. C. Stevenson. Dec. 1953. Decl. Sept. 29, 1955. 16p. Contract AT(11-1)-74.

The formation cross sections of Sr^{89}, Zr^{97}, Pd^{109}, Pd^{112}, Ag^{111}, and Ba^{140} from U^{238} bombarded with deuterons have been studied as a function of deuteron energy from 19 to 190 Mev. The results may be explained on the basis of the hypothesis of Goeckermann and Perlman (Phys. Rev. 76, 628(1949)), i.e., that the primary fission fragments are formed with the same neutron-to-proton ratio as their preceding fissioning nucleus. (auth)

2238 AEC-tr-2363

A CASE OF FISSION OF A URANIUM NUCLEUS INTO FOUR FRAGMENTS OF COMPARABLE MASS. Yu. S. Ivanov. Translated by V. N. Rimsky-Korsakoff from Doklady Akad. Nauk. S.S.S.R. 104, 40-3, 1955.

An event, which is interpreted as the fission of a U nucleus into four heavy fragments, was observed in a U-loaded photographic plate which had been exposed to a photon beam. A microphotograph of the event is shown. (B.J.H.)

2239

FISSION PRODUCT YIELDS OF URANIUM BOMBARDED WITH DEUTERONS OF VARIOUS ENERGIES (20-190-MEV). Harry G. Hicks, Peter C. Stevenson, Richard S. Gilbert, and William H. Hutchin (Univ. of California Radiation Lab., Livermore). Phys. Rev. 100, 1284-6(1955) Dec. 1.

The formation cross sections of Sr^{89}, Zr^{97}, Pd^{109}, Pd^{112}, Ag^{111}, and Ba^{140} were measured from the bombardment of natural uranium with deuterons of various energies (20-190 Mev). (auth)

2240

RADIOCHEMICAL STUDIES OF THE HIGH-ENERGY FISSION PROCESS. Harry G. Hicks and Richard S. Gilbert

(Univ. of California Radiation Lab., Livermore). Phys. Rev. 100, 1286-93(1955) Dec. 1.

Formation cross sections of a number of fission products of U^{238} have been measured as a function of bombarding particle energy using deuterons (19 to 190 Mev), protons (70 to 340 Mev), and helium ions (50 to 380 Mev). Fission product distribution curves as well as fission cross sections have been measured for deuterons and protons of the above energies. The mechanism of high-energy fission is discussed. (auth)

Refer also to abstract 2091.